THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW

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PEAT.

A propos of our remarks on Captain Sankey's B.A. paper, we must mention the highly antagonistic leading article which appears in the *Engineer* for September 18th. That article is undoubtedly written by an Irishman, and, we should surmise, by one who has suffered directly or indirectly through some failure to turn peat into gold, for under no other circumstances could an intelligent man allow himself to be so illogical.

We feel that any peat scheme must be approached and handled very cautiously indeed, but in the *Engineer* article the whole prospect is practically damned for ever, because, forsooth, someone in the middle of last century made a glorious failure of his attempt to produce a serviceable form of peat fuel, and made paraffin candles, which cost £400 apiece, from the by-products.

The writer, indeed, seems to look at the whole matter by the light of those candles. He does not attempt to question the chemical or the engineering features of the modern schemes, but directs all his heavy ordnance against the idea that the crude peat can be got successfully, and by successfully, of course, we mean cheaply enough to render the remaining processes possible on a commercial scale. He implies, with how much truth we hardly know, that the promoters of the Central Ireland scheme have yet to realise the nature of the bog, but we cannot imagine that the very A.B.C. of the subject has been passed over so lightly as he seems to suggest, and we go so far as to question the validity of his fundamental statements that a characteristic bog cannot be reclaimed because it lies too low to be drained. If he will study the most valuable collection of surveys included in the great Bog Commission's Report of last century, he will see that the characteristic bog, and the Bog of Allen is no exception, is by no means flat, and that it is served for natural drainage by a system of water-courses and rivers. We have reason to hope that this large and vitally important question will be dealt with by a better hand than ours, and, far from feeling depressed by the assumed fact that a bog must be drained before it can be dug, we believe that this apparent impossibility will be turned into a sound and practical means for the ultimate solution of the great problem: How to utilise peat.

On the other hand, it is asserted by those who have made large-scale experiments, that peat can be got in large quantities, and from the maximum depths, by machines which will work under water, so rendering drainage operations unnecessary, and in the absence of sufficiently full knowledge, we can say only that such a proposition has no element of impossibility about it, even when viewed through commercial eyes; but we would much rather see the place where peat used to be turned into smiling pastures and cornfields and forests than left a watery waste of even less value than it is at present. Such an ideal may seem preposterous to the *Engineer*, but with the example of an erst-while submarine Holland before us, who shall say that the hunger-patches of Ireland may not be made fat?

About Capt. Sankey's figures of cost we have said nothing previously and we will say nothing now, except that they are too much hedged about with "it appears," and "it is probable," or "it is estimated." Those figures are, in fact, all either estimated, or derived from the experiments, sometimes on a very large scale, of interested parties, and we should be the last to suggest that experience gained in other countries is to be applied without questioning as a criterion to Ireland and Irish conditions; but Capt. Sankey's figures transmit a great deal more of hope than of fear to the intelligent reader, and we do not think that Ireland, with its eternal dampness, provides any worse peat-getting

conditions than do those peat countries in which the bogs are frost-bound and unworkable for half the year, and it is from such bogs that some of our most valuable data have been gathered.

We end with a quotation, and a query. " . . . . there are three kinds of peat. First, on top, the light fibrous stuff which . . . . may be seen going through the streets of London for horse litter. This would not be worth carriage to the works . . . . " How then is it now worth carriage to London?

Specialisation in Manufacturing.

It is a most elementary principle in finance that to put all one's eggs into one basket is the height of folly. Geographical distribution of investments is what is aimed at by the man of experience, so that when in one direction dividends grow "small and beautifully less," this will probably be compensated for by increases in others, with resulting appreciation in capital value. An unwisely arranged geographical distribution, however, may have no ray of hopefulness anywhere, for in a mere scattering abroad there is no inevitability that security and good return will follow. The whole secret of success so far as an investor has any influence in controlling the value of his possessions, lies in a wise investigation into, and discrimination between, all the chances, viewed in the light of past experience and of reasonable probabilities.

This is not an article on principles in electrical finance, but we make these comments believing that the matter of geographical distribution has been applied in connection with electrical manufacturing. We are afraid, however, that it has not always been wisely applied; to be a manufacturer of everything electrical may not always be so profitable an undertaking as to manufacture a few special lines. There has been, and still is, an over-ambition among some electrical firms whom we might name, and they are suffering to-day through having over-reached themselves in their efforts to over-top their competitors. What does it mean when an individual applies himself to no particular calling? Is it not too frequently the case that the jack-of-all-trades becomes the master of none? He may buzz busily from flower to flower, without gathering the equivalent of honey, making a noise, but reaping little gain at any rate for his shareholders. The shoemaker is a better shoemaker because he sticks to his last, and though in the higher profession of engineering there has to be something of a flavour of versatility, there is a recognised necessity for specialisation in one particular department if real success is to be obtained.

We are not desirous of depreciating the attainments of some engineers and some manufacturers who have found whatever they have touched to be productive of benefit either to their minds or to their pockets; these, however, are the exceptions, and do not represent the generality of cases. We do not deny that it may be a good thing for the convenience of a trade to get yourselves known as universal providers, but then you have to sell what other people make, and the margin of profit may be less as a consequence. You must also with multifarious concerns divide attention, so that the consistency of one controlling hand and the advantage of a continuous policy are wanting.

Yet it is also a good, or even a better, thing to get your name indelibly fixed upon the minds of electrical engineers and buyers as that of one who has made a speciality of one particular line of manufacture which everybody wants or will want at some time or other; to have it recognised that you know the details relating to its manufacture so intimately that you are able to turn out a thing of irreproachable character; and that you are alive as to how to sell that one thing when it is made. Let it be known, also, that your system of management and works organisation is admired by those who have investigated it; and that financially you are as sound as a bell, and it will then be seen that wise as may be the dictum of the financial adviser, there is certainly after all a prospect of its being a satisfactory thing to put all your eggs into one basket in manufacturing, if the basket chosen be a sound one.

Electrical Undertakings in Japan.

ALTHOUGH the employment of electricity has already made considerable progress in Japan, a Yokohama correspondent of the *Frankfurter Zeitung* states that there is still a large field open for its use, having regard to the development of industries in that country. Not only so, but there is, perhaps, scarcely another country where so many opportunities are available for the utilisation of natural water-powers as in Japan, owing to the numerous mountains and the rapidly-flowing mountain torrents. Moreover, coal is always costly, and the various supply companies are, therefore, simply compelled to render the constantly-growing power stations remunerative by drawing upon the water-power resources of the country, especially as they seek to outstrip each other in the cheapening of the supply of electricity.

After the war with Russia, many schemes of enormous dimensions were projected for the establishment of hydro-electric works, but the first is only now to be actually carried into effect. This relates to the utilisation of the water-power of the Oigawa, which is to be undertaken by an Anglo-Japanese company. The preliminaries in connection with the company have occupied a considerable amount of time, as it was first of all impossible, as is always the case in Japan, to agree as to the method in which the participation of foreign capital should take place. The company has, however, now been brought into existence, although difficulties continued to be manifested during the issue of the shares. Originally the capital was fixed at 12,000,000 yen, of which 6,000,000 yen were to be raised in the form of shares and the remaining 6,000,000 yen provided by means of a loan to be issued in England. The shares and a loan of a company in Japan are, however, not permitted to be of equal amount, and an alteration had consequently to be made when subscriptions to the shares had just been invited. The change assumed the form of fixing the total capital at 12,500,000 yen, of which the loan represented 5,000,000 yen. Shares to the number of 125,000 remain in Japan, and with the exception of 19,200 shares which were offered to the public, all the others were taken up by large firms and banks (Mitsui, Mitsu Bishi, Okura and Baron Shibusawa).

The Tokio Electricity Co. at the same time has been compelled to add a loan of 3,000,000 yen to its share capital of 9,500,000 yen for the erection of a new water-power station of 30,000 H.P. on the Fujiyama. Two German firms were approached on the subject, and one was prepared to provide the money. The terms proposed, which had previously been accepted in connection with various industrial undertakings, were the advance of 3,000,000 yen for three years at 7 per cent., the guarantee of a sound bank and the obligation to purchase all machinery and materials from the German firm. As, however, these conditions are regarded as too stringent, the Japanese company intends to apply for the intermediation of the Kango-Ginko (Industrial Bank), which is supported by the Government, and which, the correspondent declares, has ruined the business of many foreign firms and banks.

The enormous expansion of electrical installations in Japan has naturally been accompanied by a considerable increase in the demand for cables and conductors. The requirements in this respect in 1907 amounted to 8,000,000 yen, of which the value of 5,000,000 yen was imported from other countries. Japanese wire is inferior to the imported product, and the latter is, therefore, exclusively employed on warships and steamers and for all underground cables. The most important Japanese firm in this branch has hitherto been the Yokohama Electric Wire Co., whose factory is in Yokohama. The company has now concluded an agreement with the Furukawa Copper Mines Co., which is erecting a new factory for copper wire at the Ashio copper mines. One half (1,200,000 yen) of the capital of the Yokohama firm is being taken over by the Furukawa Co., and the latter is carrying out considerable extensions of the former's factory, and will have three representatives on the board of management.

A further cable factory is projected by the firm of Sumitomo, of Osaka. Nevertheless, the correspondent concludes that an increase in the import of electrical conductors may safely be expected from abroad, including Germany.

A Minister of Commerce.

In regard to our recent comments on the Board of Trade and the need that exists for a Minister of Commerce who should be able to look after trade matters untrammelled by the manifold other concerns, which, without much misdescription, might be said to be irrelevant to the office of a President, we observe that the *Railway Gazette* does not relish the idea of the railway duties of the Board being removed and put into the hands of a Minister of Railways. Its objections appear to be that the head of a Government Department owes his appointment solely to political reasons, and that there is never any guarantee that the person appointed possesses any technical qualifications for the post. Our contemporary remarks that any possible disadvantage resulting from the lack of practical railway knowledge in a President of the Board of Trade is more or less discounted both by the limited jurisdiction of his department, and by the fact that he has so many other things to look after. An amateur with his whole official time to devote to the supervision of railway working would, we can understand, be quite at a disadvantage from the railway companies' point of view, seeing that there is the danger of having a type of politician whose eye might be constantly on the votes of trade unionists. A Department of Railways would, too, have wider scope, and consequently larger powers for interference than the present Board of Trade. All of this is very true from the railway point of view, but the unfortunate fact of the present position is that the Board of Trade has so many and varied things to watch over, that it cannot maintain a complete live control of any of them, or at any rate, when some things are done well other things may have to suffer. We do not advocate a wholesale splitting up of the duties of the Board of Trade with an Electric Light and Power Minister, a Railway Minister, and so forth, but we do say that if we had a Minister of Commerce of influence in and with the State, he could look after what are purely matters of trade and commercial concern. The Railway Department can continue to watch over its own particular province under the President, but if we can get nothing more, let there be a raising altogether of the status of the Board of Trade Commercial Department, with a commercial Goliath at the helm who is fresh from the warfare of trade rather than a man who, however useful to his party, is more accustomed to political party fights, speech-making and electioneering. A National Trade Office appointment ought to be quite non-politically given, and the man who secures it should have powers to confer with the railway department and authorities wherein the doings of railways affect the position of trade and commerce. We hope that the subject will be kept well to the fore in the interests of our future commercial progress, for there is need for legitimate Government nursing (we do not mean coddling). Surely the present time, when the country is passing through one of its cycles of bad trade, is the right one for action to be taken in the matter.

Condenser Pressures.

In a note on condensation, M. Maurice Le Blanc briefly explains the action of a condenser, or, rather, the several actions which take place concurrently in it. In any closed vessel, no matter what its vapour contents, the pressure at every point must either be uniform or in process of tending to equalise should anything have disturbed the equilibrium. This is a self-evident proposition which all engineers will accept as true, though it is, of course, permissible to argue the possibility of different pressures existing in different parts of even a small vessel.

In a vessel containing mixed vapours, the resultant pressure is the sum of what each vapour would exert if it alone were present and in the same quantity per cubic foot of space. This is according to Dalton's law.

When a vessel contains water, each cubic foot of space above that water will contain a certain mass of aqueous vapour. This mass is determined by the temperature of the water which gives rise to the vapour. It remains the same for any given temperature, no matter what other gas may be present in the space. Obviously, therefore, any air in a vessel containing water vapour simply adds so much to the pressure, and does not drive back a portion of the aqueous vapour into liquid again.

Though the pressure in a condenser must be uniform at every point, or must tend to become equal with very great rapidity, the temperature at any given point may vary from that at any other point. This will be made clear by a simple assumption. Let cold water be pumped into a closed vessel of considerable length, and at one end; let it be withdrawn at an equal rate from the other end. Let steam jets be blown through the flowing stream so that the stream of water which enters cold shall leave hot. The temperature of that vessel must be changing all through its length. Above every part of its length the space will be filled with vapour having the temperature and pressure of the water in that portion of the vessel. But this is obviously an unstable condition which cannot endure. The hotter vapour, by virtue of its higher pressure, must inevitably travel towards the region of the colder vapour. In doing so it will compress that colder vapour and raise both its pressure and temperature. The vapour at the cold end will be hotter than the water beneath it and will be condensed by that water, and there will be a continuous flow of hot vapour to the cold end, and a continuous condensation will proceed. If the flow of water and steam be now stopped this action will very soon carry so much heat from the hot to the cold end of the vessel that the water will become of equal temperature throughout. Now in steam-engine practice there is a constant influx of cold, or a causation of cold, by virtue of the abstraction of heat from the tubes by the circulating water. Also there is a continuous abstraction of hot water, and there are loci of different temperatures. There must also be loci of different pressures or a tendency to form such loci, and there must be a constant flow of vapour towards the loci of lowest pressure. Vapour will flow from all points of the condenser space towards any space where the pressure is less. If air be present, this will travel with the aqueous vapour, and if we again assume the case of a long vessel in which the water is at rest, but varies in temperature from one end to the other, and we assume that air is present, it will not be very long before the whole of the air is swept to the coldest zone. The aqueous vapour with it will condense, and ultimately there will be equilibrium established as regards pressure, but not as regards the temperature, for air not being condensable to liquid at ordinary pressures and temperatures, it will stop the further flow of hot vapour to the colder zones by itself occupying the space. There will be equilibrium of pressure attained without equilibrium of temperature by virtue of different ratios of air and aqueous vapour at different loci. In brief, air must tend to be swept by the aqueous vapour towards the colder portions of a condenser, and at such colder portion should, therefore, always be placed the draw-off outlet of the dry-air pump. Now, often this outlet is placed high, a situation which involves the sweeping upwards of the heavier of the two gases in a condenser, for air has a density of about 15 to water vapour 9. The movement in the condenser may be such as to overcome any tendency for the air to fall behind, but the foregoing reasoning seems to point to the lowest point possible as the one whence air ought to be drawn from a condenser, and where the coldest tubes should be found.

It is not possible to secure a vacuum higher than that proper to the hottest water in a condenser. To the absolute pressure of that water vapour must be added that of any air at the hottest zone. But if this air is regularly swept out of the hot zone, the condenser pressure may actually be reduced to that proper to the water temperature only. Clearly then this hot water must be promptly drawn out from the hot zone, and the air must be drawn out from the cold zone. A condenser must not be regarded as a mere jumble or disorganised mass of water, air and vapour, but as a distinct working machine in which a selective and separative action is constantly in progress, eliminating air from the hotter parts, and so reaping the fullest possible benefit from the knowledge of the law of mixed vapours.

D

NOVEL WIRE-COVERING MACHINERY.

Some Details of the Processes Employed by F. Hutchins & Co., Ltd., Harlesden.

Some two and a-half years ago, through the courtesy of Messrs. F. Hutchins & Co., the patentees, we were enabled to inspect some ingenious machinery for covering wire with cotton. As mentioned at the time, the process represented a radical departure from existing methods, and gave promise of striking results commercially. Events have proved our surmise to be well within the mark, as a recent visit to Messrs. Hutchins's works disclosed the fact that the wire-covering process has meanwhile been perfected and brought into use on a commercial scale.

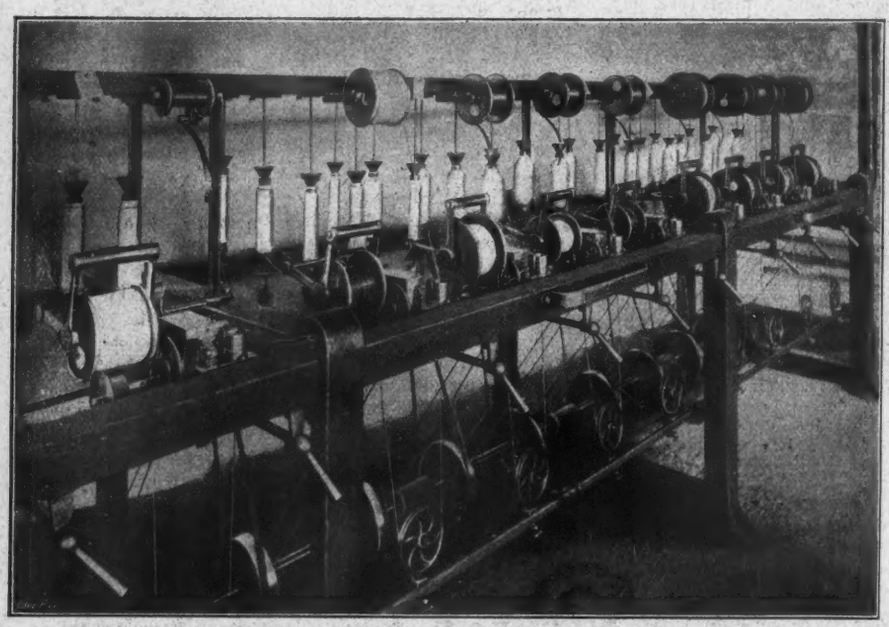


Fig. 1.—Covering Machine for Small Gauge Wires.

Not only this, but the ingenuity of the firm has been successfully directed towards the introduction of a process for polishing the covered wire, and to the production of enamelled and fireproof coverings for wires.

To return to the wire-covering process, this was described in detail in our issue of December 1st, 1905, and it is only necessary here to remind our readers that the feature of the machine is a hollow spindle of special design; this revolves at high speed inside a fixed casing connected to an exhausting fan, whereby a vacuum is created round the head of the spindle. Unspun roving is fed on to the spindle head, the fibres of the roving being drawn out, sucked in by the entering air, and whirled round and on to the wire as it passes downward through the hollow spindle.

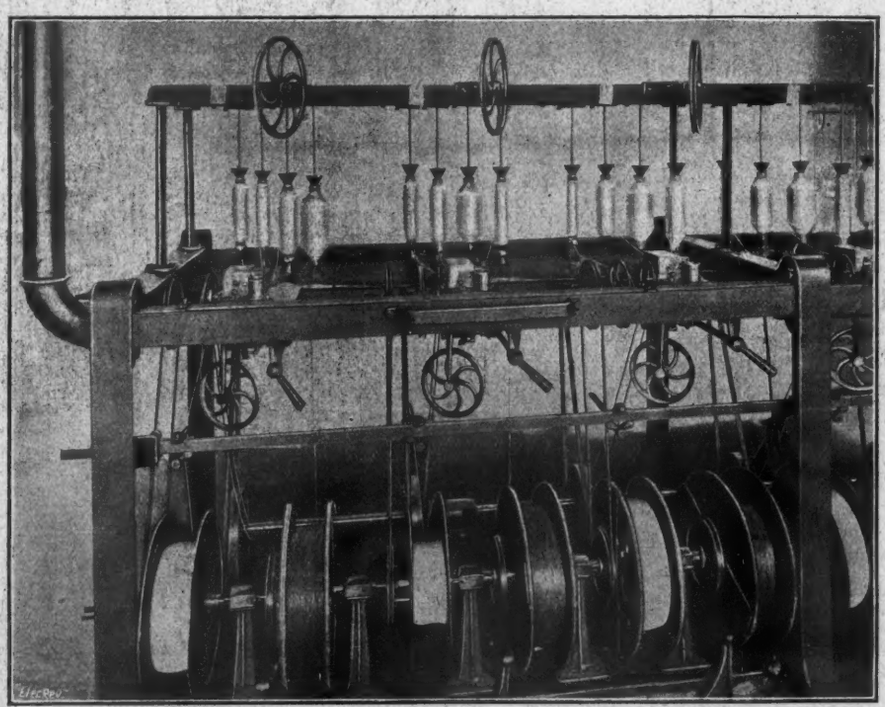


Fig. 2.—Type of Covering Machine for Heavier Gauge Wires.

Views of the covering machines as now constructed are shown in figs. 1 and 2, and fig. 4 gives a good idea of the covering plant in use by Messrs. Hutchins at the present time. CONTINUED ON PAGE

One of the principal improvements, which have been dictated by experience, is that the spindle now revolves in ball bearings, and thus obviates the necessity for the special oiling system originally used. A single set of three pairs of drawing rollers is now provided to each covering head, and these are arranged so as to be easily dismantled and accessible (fig. 3). The upper three rollers revolve on fixed spindles, the latter being held in a hinged upper block by springs; the block can be lifted up for the purpose of cleaning the rollers. The latter are suitably bushed and provided with grease reservoirs in the hubs, and one of them, on which devolves the delicate task of the final drawing-out of the fibres, is provided with a thin corrugated steel rim mounted on an annular cork lining—this flexibility being considered necessary on account of the danger of damaging the fibres in the last stage of drawing out.

Reference to our views will show the starting handles on

the front of the machines; these are arranged so that the initial movement sets the covering head and spindle in motion, a further movement starts the rollers feeding the

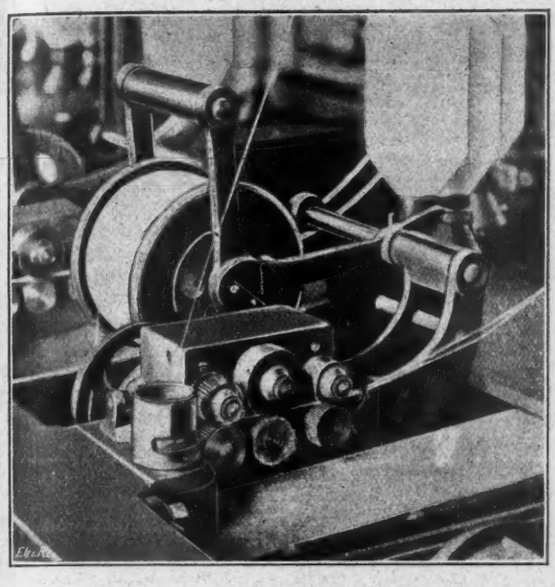


Fig. 3.—Drawing Rollers, Head of Covering Spindle and Finished-Wire Drum.

cotton, and simultaneously the driving pulley, which is seen under the covered wire bobbin (fig. 1), and which in rotating draws the wire through the machine. The bobbin has a purely frictional drive, and the arrangement secures a uniform speed of wire through the spindle.

These details indicate to some extent the careful design of the machine, which it is not surprising to learn has proved so certain and reliable in operation as to lead to the discarding of the automatic electric control gear, described in our former article, for detecting imperfections in the insulation.

The adaptability of the spindle is indicated by the fact that only two sizes are used, and these two cover a range of wire from the finest up to No. 9 S.W.G. (·144 in.), being used on one or other of four different types of machine arranged for different speeds of covering. There are no adjustments to be made when altering the size of wire, beyond changing a spring used inside the spindle head—though even here there is no exactness required, as one strength of spring is effective for a considerable range of sizes of wire. The thickness of the cotton covering is altered by varying the size of roving used, and an endless variety is obtainable with comparatively few sizes, as two, three or four rovings can be used together, and even rovings of different counts, in order to give the requisite thickness of cotton for a particular size of wire.

It may be interesting to mention that a covering speed of over 80 ft. per minute is maintained for wire up to No. 22 gauge, of which particular size one spindle will cover nearly 100 lb. per day. Larger wires become unmanageable at this high velocity, and are run at correspondingly reduced speeds.

Polishing Process.—Another ingenious machine, which we illustrate in fig. 5, has been devised for varnishing and polishing magnet and bell wires, and at the same time giving them distinctive colours if desired. This type of machine is built in three sizes for dealing with wires from 12 to 38 S.W.G.; the machine illustrated will deal with 12 separate drums of wire at the same time, being of the multiple type, similar to the covering machines.

The feature of this machine is the polishing spindle, a patented device (shown separately in fig. 6), which resembles a twist drill attached to a pulley, and supported in ball bearings. The wire, after being impregnated with a special compound, is drawn up through the groove in the spindle, which, in rotating, both wipes and polishes the wire. No matter what may be the consistency of the compound, or the amount of it taken up by the wire, the surplus is wiped away, and thrown off by centrifugal force, thus preventing clogging.

Reference to fig. 5 will show the wire drums supported on the lower portion of the machine; covered wire from the near drum is led into the small rectangular bath of compound just above, passes under a pulley and up through the polishing spindle previously referred to (the pulley for which

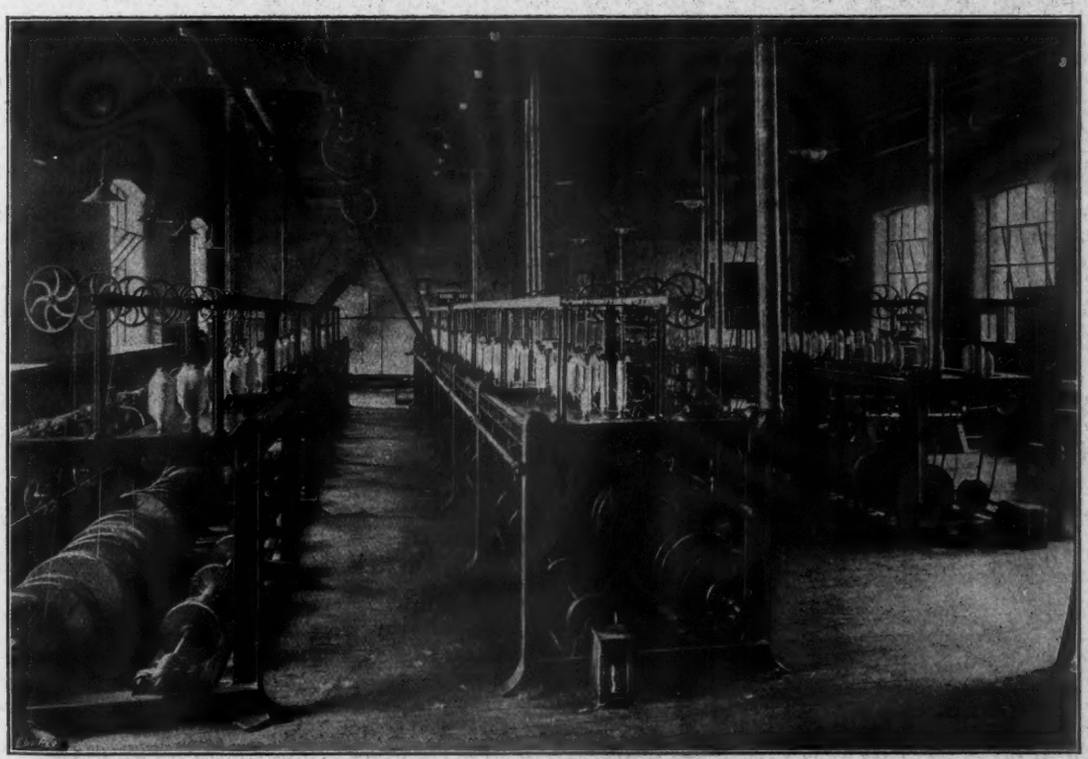


Fig. 4.—Interior of Messrs. F. Hutchins & Co.'s Wire Covering Department.

is centrally bored), and up through a gas heated tube to a second similar polisher (seen at the top of the frame), after which it is returned over guide pulleys, twice again through the heated tube to receive a final baking, and then passes down to the second drum in its finished state.

A uniform speed of travel of the wire is secured by passing the latter once round a driving pulley prior to winding on the finished-wire drum; and the drum itself is provided with a slipping drive in order to allow its speed to adjust itself to that of the wire.

The starting levers for each section of the machine can be seen behind the wire driving pulleys; movement of a starting lever simultaneously sets the wire, and upper and lower polishing spindles in motion, and turns on the gas in the heated tubes—these being provided with pilot lights.

Those who have used springs and other wiping and polishing arrangements will appreciate the great simplicity of the device described above.

The machine can be used for paraffin wax and other such compounds, though the mixture ordinarily used for magnet wires is of a special kind, the wires finished with it having a smooth, hard, yet flexible surface, well adapted for rough usage.

Enamelled Wire.—Foreseeing the likelihood of a demand for enamelled wire, Messrs. Hutchins have turned their attention to devising a suitable apparatus for this work also. The machine is simple in construction, consisting primarily of a large gas heated tube fixed over a bath of enamel; the wire is led four times in succession through the bath and up the heated tube, thus obtaining four distinct coats of enamel.

With the aid of the various processes described, a new product has been arrived at, which the makers claim to be the "last word" in magnet wires. This consists of wire which, after being enamelled, is coated with a very thin covering—only a mil or two thick—of asbestos, a smooth surface being produced by a final polishing. Samples of this wire appear to confirm Messrs. Hutchins's claim that it fulfils every possible requirement for an ideal magnet wire. An objection to the use of ordinary enamelled wire is that for some purposes, as, for instance, on the armature of a motor, it is liable to chafe, as the result of vibration and changes of temperature; a cotton covering over the enamel meets this difficulty, but the cotton takes up considerable space, and is, of course, combustible. A covering of asbestos of the thickness mentioned, whilst not materially increasing the space taken up by the wire, prevents damage to the enamel and is not affected by a high temperature. Plain asbestos is not an ideal insulator, but here the enamel provides the necessary insulating qualities, and the asbestos is put on in such a way that it cannot absorb moisture. We understand that the cost of the wire will be by no means prohibitive, more especially as the patentees are able to use for their purpose a very cheap form of asbestos.

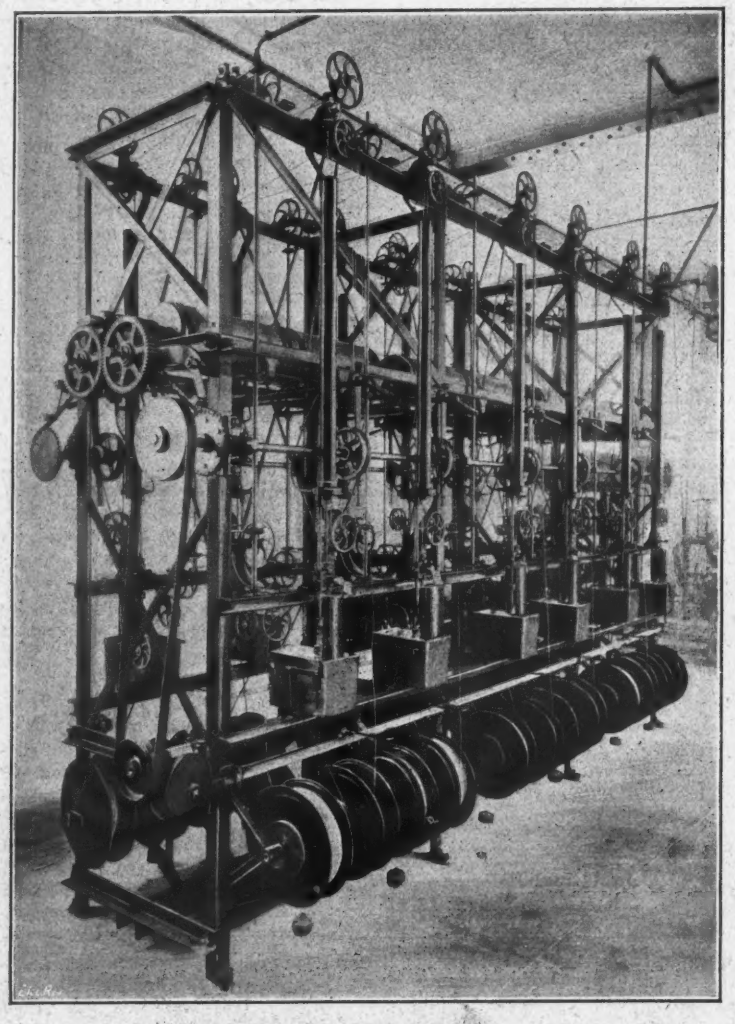


Fig. 5.—Messrs. Hutchins's Patent Polishing Machine.

Joint Lapper.—Although originally designed merely for use in the makers' own factory, the patent joint lapper shown in fig. 7 should be useful wherever magnet wires are employed. The insulation of joints is a tedious operation, and it requires some skill to do it well; with this little machine, the wire can be quickly and neatly insulated with silk, even by a novice.

The illustration shows clearly the method of using the machine. The bobbin of silk is attached to a slotted spindle running in a slotted bearing, so that in one position, with the slots in line, the wire can be taken in and out. The rollers on the right, between which the wire passes, are for giving a right or left-hand traverse to it automatically. The wire being placed in position and the end of the silk held on the wire to start it, with a few turns of the handle the joint or bare place in the wire is quickly and evenly lapped. If a second covering is required, the traverse roller is reversed, and the handle again turned in the same direction as before. A neatly insulated joint is appreciated by a coil winder who has to get a definite number of turns in a given space, and, the machine being quite portable, it can be readily placed in any position convenient for the work in hand.

In spite of the fact that it is little over two years since Messrs. Hutchins & Co. first put their patent wire on the market, they have already found their premises too small, and have recently built a second spacious four-floor factory, with ample room for further extensions. The age of the firm, however, does not indicate the extent of their experience; the works manager, Mr. W. A. Phillips—who, jointly with Mr. F. Hutchins, has been responsible for the development of their various processes—having made and sold silk-covered wire, on a machine of his own manufacture, as far back as 1869. Mr. Phillips also claims to have covered, shortly after this, the wire used on the first Gramme dynamos manufactured in this country.

In conclusion, we may emphasise what should be evident from our articles, that Messrs. Hutchins's aim has been to produce specialities; that they have been successful in this direction is equally evident.

The machines required for the various processes described, have been produced throughout in the firm's own engineering department, which is equipped with modern

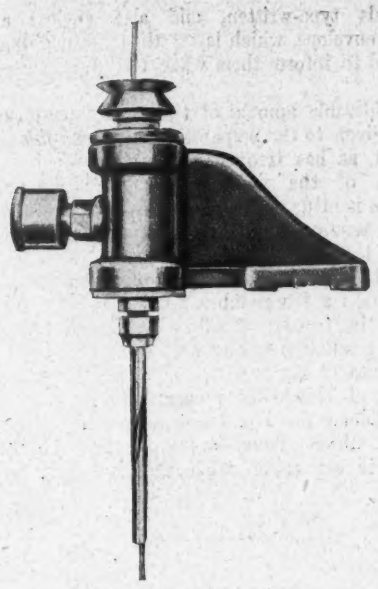


Fig. 6.—View of Polishing Spindle and Pulley (see p. 525).

high-class plant. Our thanks are due both to Mr. F. Hutchins and to Mr. W. A. Phillips for the opportunity given us of recording our impressions of an interesting visit.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Auto-Transformer Installations.

With reference to the letter signed "B. W. H.," appearing in your issue of September 18th, I think your correspondent is misinformed in attributing any disadvantages to the use of 25-volt "Osram" lamps and transformers.

In the letter from the Ampere Electrical Co., in the same issue, it is most clearly stated and proved that the plan is a thoroughly feasible and economical one, and that it has also been done to a very large extent—with great success—in Dublin, where the supply is 200 volts, 50 cycles. Also on the authority of the editor of the Electrical Review, it is stated in the issue of September 24th that there is no doubt about the practicability of the system, and that a great number of such installations have been successfully carried out.

Regarding the metal-filament lamps referred to—16 and 25 c.p., sold at 2s. 6d. This is obviously the "Tanta'um" lamp, and accepting the makers' stated efficiency—a 16-c.p. 100-volt "Tantalum" lamp in 1,000 hours, with current at 4d. per unit, will consume 9s. 4d. worth of electricity—whereas a 16-c.p. (English standard) 25-volt "Osram" lamp in the same period and with current at the same price would only consume 6s. 4d. worth of electricity, which means an approximate saving of 33 per cent.

The fluctuation of light referred to does not take place in practice unless the original installation has been very scantily wired. The risk of burning-out of the transformer is negligible, as also are the transformer losses.

I certainly believe that until we can obtain a 16-c.p. 100-volt or 200-volt lamp with the efficiency of the "Osram," the practice of transforming down to 25 volts on alternating supplies will be an ever-increasing one.

M. C. St. J. S.

With reference to a letter from "B. W. H." in your issue of the 18th inst., may I make a few remarks relating to his objections.

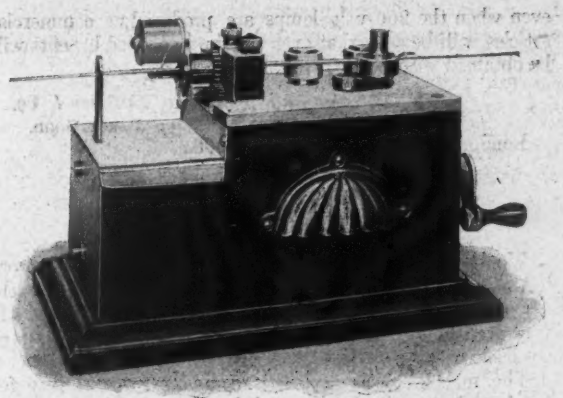


Fig. 7.—Lapping Machine for Insulating Joints.

The fluctuation of light when the lamps are switched on and off is due partly to the large current taken momentarily by the tungsten lamp (if this fluctuation is very great it is probably due to bad fuse connections). Certainly no consumer would be willing to pay more for his electric light in order to do away with this slight defect.

If the Fire Insurance Companies were not so indifferent to the quality of wiring in private houses, they would probably reduce their premium in cases where the 25-volt circuit is used, owing to the extreme improbability of an outbreak of fire due to the electrical installation. In my own house, which was originally wired disgracefully by a contractor for the builder at 6s. per point, I have had the pressure reduced to 25 volts, with the result that one can short-circuit any fitting without running the least risk of fire. The wires and transformer combined make a convenient resistance for dissipating the energy when a short circuit takes place. The risk of a burnt-out transformer certainly exists, as does at present the risk of a burnt-out main fuse, but in the whole of my no small experience with transformers, I do not remember a single case of burn-out. It must also be remembered that it takes no longer to get a transformer replaced than it does to get a main switch renewed.

Let me put this question: Should a consumer pay 50 per cent. more for his light in order to remove a ten-thousand to one chance of temporary failure?

Finally, the possibility of the production in the near future of a 200-volt 8-c.p. metal-filament lamp, is raised as an argument against the installation of transformers and low-voltage lamps. But of what value is this argument? To begin with, we are unlikely to get these lamps for some months, and certainly not before present users of the low-voltage system have more than recovered their capital outlay in transformers and lamps. Further, when these lamps are actually on the market the arguments in favour of transforming to low-pressures are overwhelmingly in favour of the small outlay entailed. To mention a few salient points—considerably cheaper lamps, hardier and more lasting filaments, far less risk of fire, and almost certainly more rationally sized bulbs. Commercially, the first two points absolutely carry the day.

Let me give a striking example relating to carbon lamps, with which I was personally in touch.

Some years ago I was connected with a firm of consulting engineers who had the control of the lighting of a very large block of buildings in London. The supply company raised the pressure from 100 volts to 200 volts, and immediately the cost of lighting this building went up, I think, nearly 30 per cent. After much consideration and testing, it was decided to reduce the pressure back to 100 volts with an immediate benefit which more than counter-balanced the cost of transforming. Since then I have during the past few years arranged many installations, and whenever they were supplied at 200 volts, efforts have been made to use as many 100-volt lamps as possible, and in all cases it was found to repay the cost rapidly. In fact, to any considerable user of electric lamps on alternating circuits, it pays to install a transformer to reduce the pressure to 100 volts, still using carbon lamps.

In view of this, is it not more than reasonable to believe that with the 25 and 50-volt tungsten lamps the advantages,

even when the 200-volt lamps are produced as commercial articles, will be such that even more pronounced benefits will be obtained with the low-voltage system?

Neville Williams & Co.
pp. Percy Good.

London, S.E., *September 26th*, 1908.

Metallic-Filament Lamps.

We have read with considerable interest a letter from "Another Contractor" in your issue of September 18th. Our experience is that the metallic-filament lamp business is very profitable, provided that only thoroughly reliable lamps are dealt with.

The makers' guarantee with regard to responsibility for breakage in transit of "Osram" lamps, as set forth in their catalogue, is as follows:—

"When lamps are ordered in quantities of 50 and 100, or multiples of same, of one kind, they are dispatched in our anti-vibration barrels, for which no charge is made. We guarantee sound delivery of any lamps which are sent in these anti-vibration barrels, and will replace or credit any which may be broken in transit from our warehouses to our customers' premises, provided such broken lamps are returned to us, carriage paid, and duly advised within one week after receipt of goods."

Therefore, if your correspondent has had lamps broken in transit, sent out in the minimum quantities to come under this sound delivery guarantee, and has been refused replacement, he has an obvious remedy, as he cannot be made to pay for the broken lamps.

With regard to the difference between filaments broken mechanically and filaments broken electrically, we have given some attention to this matter, and, in our opinion, it is nearly always possible to state with a very tolerable degree of accuracy whether a lamp has prematurely failed when on circuit (in which case, when the filament is examined under an ordinary magnifying glass, distinct traces of burning at the broken ends of the filaments can be seen), or whether the filament has been broken mechanically, *i.e.*, through some rough or improper usage, for which the makers naturally do not hold themselves responsible.

W. M. B.

With reference to the letter from your correspondent, "Another Contractor," in the Electrical Review, September 18th, if the lamps referred to are Osram lamps, we would ask the writer to communicate with us, giving details of the transaction, because we think it is very generally known that we guarantee sound delivery of Osram lamps, as per the details given in our catalogues and quotations, and if your correspondent has been refused credit for any lamps broken in transit, sent out under our sound delivery guarantee, we can only conclude that he has not returned them to us as "transit breakages." It will be readily understood, we feel sure, that there is a distinct difference between "transit breakages" and "stock breakages."

J. Y. Fletcher,
Manager, Osram Lamp Department,
The General Electric Co., Ltd.

London, E.C., *September 25th*, 1908.

Applications for Situations.

Some time ago you kindly published a number of letters, the writers of which invited those advertising in your "Situations Vacant" to insert a small notice when the vacancy was filled. Some few firms have made use of this means of informing and thanking applicants, but a large majority still seem to think the matter of too small moment to warrant the trouble or expense.

I should like, with your kind permission, to bring to the notice of your readers another cause for complaint in relation to the same subject.

Many applicants for positions advertised in your columns take the trouble to have their applications and copies of testimonials type-written, and also enclose a stamped addressed envelope, which latter they reasonably expect will be utilised to inform them when the appointment has been made.

A considerable amount of time and thought must necessarily be given to the preparation of a *bonâ-fide* application, and when, as has frequently happened within the recent experience of the writer, no acknowledgment of any description is made, one naturally doubts whether the application has been opened or even received, and if so, what has become of the prepaid postage.

Owing to the prevailing custom of advertisers hiding their identity under a box number, applicants have no means of discriminating as to the standing of firms advertising, and no chance of retaliation against such treatment.

In support of my protest, and, if necessary, as a proof of *bona-fides*, I should be prepared to send on to you in strict confidence the box numbers of several recent advertisements which have appeared in the Electrical Review, in connection with which I have grounds for complaint.

A Bitten One.

The Woltereck Process.

My attention has been called to the reference in your paper to my paper read before the British Association. As this reference contains, to say the least, a number of inaccuracies, I beg to request that you will kindly give these lines a space in your Review.

The lantern slides showed the works at Carnlough, co. Antrim, where the process was tested on the largest scale and reported upon by Messrs. A. Gordon Salamon and B. E. R. Newlands.

The remarks of Mr. Rigby referred to a test of the process made at the Willesden experimental plant, where peat containing 2-2·3 per cent of nitrogen produced 9·1 per cent. sulphate of ammonia, or 203·8 lb. per ton of dry peat.

The statement of the gases containing 6-8 per cent. carbon monoxide was also made by Mr. Rigby. This observation was made in a week's run during a short period (less than half an hour) when the temperature had temporarily risen on account of channelling in the experimental furnace. Observations taken during several months have shown that the average of carbon monoxide does not exceed 1·8 per cent.

As to the margin of profit on the commercial scale, I need only point out that on a minimum yield of 5 per cent. sulphate of ammonia the total cost of production, without considering any by-products, amounts to £7 19s., or with a minimum value for the same to £5 8s. 3d., taking the cost of peat at 4s. 4d. per ton of dry peat, used with 70 per cent. of water. Against this there is the selling price of £11-£12 per ton of sulphate.

For your further information I beg to enclose a pamphlet and the report on my process referred to, published by the owners of the process, the Sulphate of Ammonia Co., Ltd.

Finally, I beg to draw your attention to the more accurate report of the discussion in the *Engineer* of September 18th, page 288.

Herman Woltereck.

London, E.C., *September 21st*, 1908.

[We regret that Dr. Woltereck is displeased with our report of the discussion on peat in Section B, but we cannot admit his charges. Neither his remarks nor the slides shown suggested that the plant erected at Carnlough had already passed the experimental stage. The objection to carbon monoxide raised during the discussion was based on the figures we gave; Dr. Woltereck's more favourable average of 1·8 per cent. is evidently liable to large variation, and carbon monoxide is a dangerous gas. As to the margin for profit, we cannot do better than quote the *Engineer*, to which Dr. Woltereck refers us. Our contemporary says:—"... the doctor had pointed out that the margin for profit was very small."—Eds. E.R.]

[A correspondent, Mr. J. A. Smyth, of Cambridge, writing on this subject, draws attention to an article in the

Engineering Magazine for August, by Mr. White, describing a process for distilling alcohol from peat.—Eds. E.R.]

Rail Corrugation.

The *résumé* of the report of Herr A. Busse on behalf of the Committee on Rail Corrugation, presented at the Munich Congress of the International Tramways Union, given on page 519, September 25th, 1908, contains one or two points upon which I should like briefly to comment.

Herr Busse's Committee, under cause No. 1, suggest etching tests and careful calibration of rails. Now we know that the slightest change in the humidity of the atmosphere so affects the contact of wheel and rail that the behaviour of ordinary tramcars is immediately noticeably different. Furthermore, difference is even more marked by presence or absence of thick or impalpable grit; and yet no mention whatever is given of the nature of rail surface. No. 2 is "Too hard tires." Grit embeds more in a soft tire, and that the rail-chawing propensities of a wheel are thus improved is a sufficient comment. No. 6c, "Difference in level between the two rails"—it should be noted that the difference in vertical resiliency, or effective difference when the line load of the wheels passes, is often quite a different thing to the apparent rail level when no car is present.

The non-parallel axles of No. 6k presumably means axles intended to be parallel, but by faulty workmanship built rigidly into the truck frames so that the car placed on a plain floor would run in a regular circle. It is highly improbable that such set of axles would cause "slinging," meaning oscillation, of cars any more than it would tend to prevent it. Referring to No. 6l, "Defective trucks"—in view of the experience of Mr. A. L. C. Fell and others who have especially perfect parallel axle trucks, that they corrugate rails quickly, it is rather conceivable that a truck which might otherwise be considered "defective," might be an ideal "non-corrugator." It is time we, for technical purposes, dropped the word truck and spoke of the relation of the body to the track (particularly dynamic) and the wheel to both. So long as we have the commercial term "truck," and the "truck" is the Cinderella of traction, and we console ourselves that the truck is "defective," we shall make no progress. No. 6 m states that "slinging" is caused through too short wheel base. As a matter of fact, the reverse is really the case. A ladder carried on the shoulder of one man will "sling" less than the same ladder carried on the shoulders of two men. The causes of corrugation No. 5 "high-speed travelling," and No. 8 "rigidity of track," were both present at the Berlin-Zossen trials when "rigidity of track" came off second best, all of which leaves me convinced that until all our rolling-stock designers employ the traction trajectory method, we are to expect and puzzle over rail corrugation—and worse things.

J. Sutherland Warner.

London, S.W., *September 28th*, 1908.

Fig. 1.—"Le Radiant" Oven, "Popular" Type.

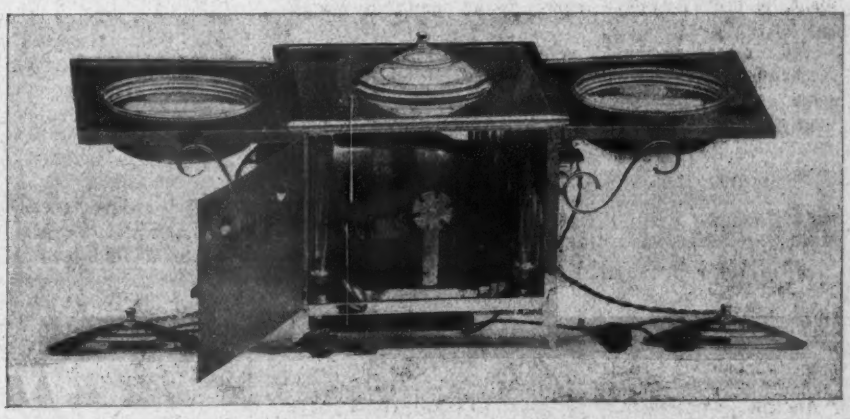


Fig. 2.—"Le Radiant" 12-Lamp Oven.

Inquiries.—A correspondent wants the names of makers of Alpha connectors and Tegit insulating material.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

"Le Radiant" Heating and Cooking Apparatus.

Mr. C. Fonteyn, of 76, Newman Street, Oxford Street, W., has sent us particulars of "Le Radiant" electrical apparatus for heating and cooking, for which he is the sole concessionaire for the United Kingdom and the Colonies. In these apparatus glow lamps of special construction are used, run at a moderate temperature, and consuming from 110 to 140 watts each. Cookers and radiators are made in this system in a variety of forms; those that we illustrate herewith are two ovens, one (fig. 2) fitted with extra cooking apparatus at the sides, and capable of cooking a 6-lb. joint, two vegetables and soup simultaneously, this being a handsome nickel-plated outfit with 12 lamps, and the other (fig. 1) a "Popular" oven of galvanised iron, with nine lamps, specially made to meet the demand for a good oven at a moderate price, suitable for hiring out by electricity supply authorities. With all the lamps burning, the former consumes 1,700 watts, while the latter, with six lamps in use, takes 900 watts. In both cases the oven measures 13 × 14 × 15 in.

THE ELECTRICAL CONGRESS AT MARSEILLES.

This Congress, whose meetings extended over eight days from September 13th to 20th, has been a practical success. Its enrolled members numbered over 1,400; the papers read were numerous, many of them of first-class excellence, and several ponderous in length and thoroughness; the debates were often lively, vigorous, and of such technical character as to prove amply the familiarity of the speakers with practice in the various branches of electrical industry discussed; the excursions to electrical works were most interesting, and were favoured by good weather as well as by the hospitality of the companies whose installations were inspected. The 1,400 or 1,500 members were, for the most part, French, but also included a large number of Italians and Swiss, some Germans, a fair contingent from Russia, several from Belgium and Sweden, a party from the U.S. of America, and another smaller party from Canada. Britain was represented by one Englishman, one Scotchman, and a Belgian who had once visited Dublin. French was the only language spoken, not invariably with Parisian purity; but the variety of doubtful accent and grammar gave the proper flavour of Internationality which was desired.

As an International Congress it could hardly claim to be fully representative, the more so because neither the British Government nor the Institution of Electrical Engineers sent any delegates. As some eight or nine Governments were officially represented, if Britain had similarly joined in this International effort, decisions and conclusions of general world-wide importance might have resulted from the meeting, because, apart from British opinion, the membership included sufficient scientific brilliance and technical knowledge and skill to give a fair measure of authority to decisions that might have been voted. But nothing of wide importance of this sort issued from the gathering. Such questions as were put to the vote were almost wholly of purely French interest—in fact, most of them were suggestions to the French profession and the French Government to adopt the already established practice in certain matters of other nations. Indeed, it may be doubted whether France is the best ground for a truly International Conference. The Frenchman takes too little interest in what goes on in the world outside France, and is too commonly unacquainted with any other language than his own, to make him a fully competent international organiser. And lack of intelligent organisation was only too obvious in this particular Congress. Material in good papers and reports and personal competence for debate were present in abundance or superabundance. But papers on practically the same subject were scattered recklessly through different sections, and were debated on different days or in different places on the same day; so that the men most interested could not take part in all they desired, and time was wasted in useless repetition. Papers promised on the printed programme for one Section were read in other Sections; several of the most interesting papers were not mentioned at all on the printed programmes from day to day; the printed copies of some of the most important papers did not arrive from the printers until after the papers had been read; the printed *procès-verbaux sommaires* issued daily of the previous day's proceedings were absurdly inadequate, and abounded in errors as regards names, &c.; and while one-half of the Sections were so overloaded that few, if any, of the subjects presented in them were given time for full discussion, the other half were given almost nothing to do, spent one hour or half an hour over a sitting, and suspended their sittings early in the week.

The Congress was opened on Monday at the Theatre in the Electrical Exhibition grounds by a short speech, resuming the rapid progress of electrical industry, by the elected president, Prof. Maurice Lévy. Then Prof. Ch. Fabry, of Marseilles, explained what could be seen at this Exhibition, and the rest of this first day was spent in a scattered saunter round the grounds, the things of greatest interest to see being the tests of cables at 300,000 volts, and the first dynamos made by Pacinotti and Gramme. Next day the Congress was divided into nine Sections, namely:—

I. Laws and Regulations; President, Maurice Lévy.

II. Design and Protection of Electric Networks; President, M. Grosselin.

III. Projects, Technical, Commercial and Economic; President, M. Boissonnas.

IV. Lighting and Domestic Work; President, Prof. Ch. Fabry.

V. Industry, Mines, Traction, Agriculture; President, M. Boucherot.

VI. Electro-Chemistry and Electro-Metallurgy; President, M. Gall.

VII. Telegraphy and Telephony; President, M. Devaux-Charbonnel.

VIII. Measures, Instruments and Education; President, Prof. P. Janet.

IX. Hygiene and Medicine; President, M. Bergonié.

It is hardly necessary to report that Sections III, V and VIII were those which had not time to do the work proposed for them. We may first sketch very briefly the proceedings in each Section in turn, and then make some mention of the works visited in the afternoons.

Little of consequence occurred in Section I. It sat for three days, each sitting lasting from one-half to a full hour.

The proceedings in Section II were of much higher interest. On Tuesday subterranean cables were discussed in a paper by M. de Marchena, of the Thomson-Houston Co., and certain recommendations were voted, including a three-fold factor of safety for manufacturers' insulation tests, and a two to two and a-half-fold ditto for the insulation test after laying, and warnings respecting maximum pressures due to resonance, &c. Next day the chief paper was by M. Grosselin upon protection from pulses of extra-high-pressure due to resonance and reflection of waves on long lines arising from sudden switching or extinction of short circuits, and also from atmospheric discharges. The protecting apparatus used was considered in six main classes, and the action of these analysed in detail. More experimental research as to the actual effects produced was asked for, and a desideratum is the improvement of the apparatus, such that their action will not itself produce further oscillation in the system. The paper was lengthily discussed, and the general opinion was that the apparatus in use gave sufficient practical security. On Thursday this Section devoted most of its time to the consideration of electrolytic effects of transmission and distribution lines, and more certified statistical information regarding these effects was asked for. The suitability of aluminium for aerial lines was the subject of a paper by M. Dusaugey, and its advantages as a conductor were fully recognised. Its mechanical properties and the methods of its attachment to the insulating supports require further improvement, while also the commercial value of the metal is largely destroyed in case of breakage of the line. The poles and insulators used on aerial lines formed the next subject of discussion, papers by MM. Nègre, Gourjon and Semenza being read. That of M. Gourjon dealt with the use of armoured concrete for poles, and that of M. Guido Semenza, of Milan, detailed a most interesting series of test researches upon the various new forms of porcelain and glass insulators for high pressures. Large diameter has greater useful influence than multiplicity of petticoats, and a maximum of symmetry in the general outline of the vertical section and distribution of insulating material increases the disruptive insulation. The details of this important paper are well worth studying. One point arising out of the discussion was the chief importance of the superposition of high-frequency currents upon the main transmission currents in breaking down the insulation at detached special points. This discussion and short papers by MM. Blondin and Barris upon methods of calculation occupied the whole of Friday's sitting, while Saturday was devoted to more formal affairs.

The first paper read in Section III was by M. George upon tariff-systems of charging for electric supply, a subject here, as elsewhere, always inciting to animated debate, but upon which no common agreement ever arises, the points of view of the technical engineer and of the financier being kept too much apart, and being too little comprehended mutually by the one and the other party to the dispute. Next day economic questions were again raised by papers from MM. Boissonnas,

Lépine, and Doucerain, upon the comparison of various modes of electric energy-transmission, upon the general technical and commercial management of electric schemes of large dimensions, and upon electrical insurance; and, again, later in the week by M. Brylinski's very interesting paper on the use of earth returns.

There is no space to summarise here these valuable papers, nor the prolonged, and sometimes warm, debates to which they gave rise. M. Mailloux, chief of the American delegation, was a frequent contributor to these discussions, and others who spoke were MM. Loucheur, Bloch, Vaudrey, Vedovelli, A. de Vençay, R. H. Smith, and Perego. Great insistance was laid upon the necessity of teaching children in the National Schools the elements of danger in connection with transmission lines, and of the methods of first aid to be given to persons disabled by shock.

The French system of insurance evidently requires reform in the direction of much greater flexibility, and suggestions from German, American, and English practice were freely and vigorously urged. A sub-commission to carry out these suggestions was finally appointed. On the question of earth returns, it was admitted that every sort of objectionable result from earth currents was proportional solely to the magnitude of the current, and not in any degree to the voltage employed; while M. Vedovelli described a means of estimating the efficiency of an earth-plate design. On Friday this Section occupied itself with the study of the economic value of batteries, especially when different prices are charged for energy in different portions of the 24-hour period.

Photometry was the first subject occupying the attention of Section IV, and nothing definite issued from a long discussion. Next day this Section did not meet, and on Thursday a long paper by M. Goisot upon domestic heating and upon baking by electricity was the centre of interest. Friday was devoted to arc and incandescent lamps.

No. V was a very much over-loaded Section. It began work by listening to M. Brunswick's lengthy paper upon mine installations—pumps, fans, lighting, haulage, excavation, and the relative advantages of continuous and three-phase current. After a lively and well maintained discussion on this subject, a paper upon railway traction by M. Janin was read; another by M. Sauvage on the multiple-unit system upon metropolitan and suburban lines; and again an analytical and very complete study of the action of continuous current traction-motors by M. de Traz. These papers and one by M. Routin upon automatic governors and electric servo-motors (*i.e.*, relays) operated either by change of velocity or by acceleration or by both, led to much very interesting debate on Wednesday. On Thursday M. Korda explained the Heyland-Korda unipolar transformer. One of these, of 150 KW. capacity, transforming from 6,000 volts two-phase at 50 frequency to continuous current at 120 volts, may be seen in the Marseilles Exhibition. It is a four-pole machine, and runs at 1,500 R.P.M.

Then M. Gratzmuller read a paper on "Mono-phase Traction Motors," which subject M. Latour developed at great length and rapidity. M. Ed. Tissot presented a *résumé* of his report of 62 pages, comparing different systems of electric traction. It was shortly discussed by MM. de Traz and Latour. The pity was that more time could not be given to the consideration of this very valuable paper, which presents, perhaps, more complete statistical and technical information on electric railway traction than has ever before been condensed into three or four times the space. The whole week of the sitting of the Congress might well have been spent upon it, and it will afford the members food for study for several months to come. This Thursday's sitting was extended to hear Prof. R. Swyngedauw, of Lille University, discourse upon the choice of sections and of voltages to give the maximum of economy in different circumstances. The economy problem was considered under the three aspects of minimum expenditure, of maximum total profit with given capital expenditure, and of maximum ratio of profit to capital sunk; the three solutions differing from each other.

On Friday, papers upon canal traction, a new class of electric vibratory motors, the ventilation and commutation of traction motors, and a long report upon the use of electric motors in workshops were read by MM. Legouez, de Grièges, and de Traz. On Saturday the chief speakers were MM. Bourdel, Rucher, Cumont (upon signalling), and Mailloux (upon measures of acceleration). Of course, there was no time for the proper discussion of these papers; and two long and important papers, on accumulators, by M. A. Nissou, and on the general subject of electric railway traction, by M. Janin, were never reached.

Section VI devoted its first day to the electro-metallurgy of copper, and to the manufacture of calcium cyanamide. The latter subject was taken up again on Thursday, when also M. Gall gave a *résumé* of a long report upon the present general condition of electro-chemical industry, and M. Dony-Hénault one upon the progress made in electro-chemical theory. On Friday ozone was the subject of consideration at a short sitting. The time of this Section was little employed, although some of the reports presented were very lengthy.

In Section VII the chief papers were those by M. C. Tissot on wireless telephony, and by M. Devaux-Charbonnel upon rapid telegraphy, and an interesting discussion was maintained for short periods during the first three days. But the matter forthcoming was unequal to filling more than a third of the time allotted.

The programme of Section VIII was too heavy. Much time was spent upon papers on measuring instruments, and only part of Friday and Saturday was devoted to the training of engineers. Why two such large and generally interesting subjects as measuring instruments and education should be crammed into one Section passes the comprehension of the Anglo-Saxon intelligence. In this debate, perhaps the most remarkable feature was a very serious protest by M. Mazan, chief electrical engineer of the Chemin de Fer de l'Est, against the production of an excessive number of highly-trained electrical engineers, for whom no employment could be found at all remunerative in proportion to the cost of their education or to their intellectual merit.

The education debate arose on the reading of a short paper by M. Blondel entitled "What should an Electrical Engineer be?" There was an extremely thorough and painstaking report prepared by MM. P. Janet and Chaumat—of 103 pages filled with all sorts of tables—describing the actually existing education and training given in electrotechnical schools all over the world; but no time was left even for the presentation of this report. It is to be hoped that it will be published *in extenso* in at least the journals of France, where the information is practically most needed. In the discussion at this Congress letters from Col. Crompton and Mr. Parshall were read. M. Swyngedauw insisted strongly upon the necessity of a high standard of mathematical teaching; and other speakers were MM. Barbillion, Heinrich, de Chatelain, Mr. O. Higman, chief delegate from Canada, Prof. R. H. Smith, and MM. Camichel and Gossart.

On Tuesday afternoon visits were made to the Allanch transformer station and to the tramway steam generating station at St. Giniez, and on Wednesday, one to the Cap Pinède steam turbo-generating station; on Thursday an excellent lecture was given by Prof. Abraham on the Rheograph, while in the evening a dinner at one of the Exhibition restaurants was indulged in; on Friday the large new Curtis turbine generating station of the Gaz Co., of Marseilles, was inspected, and a popular lecture on wireless telegraphy was listened to at the Exposition. Saturday afternoon was devoted to complimentary speeches at the formal closure of the Congress.

A French View of the Patents Act.—The *Times* quotes the views of M. Yves Guyot on this Act as expressed recently in the *Siècle*:—"The object of the Act," says M. Yves Guyot, "is undoubtedly protectionist. It is intended, by compelling manufacturers to set up factories in the United Kingdom, to provide employment for the British workman. This may be all very well for the workmen, but what about the British manufacturer, who will find foreign competitors springing up all around him?" "Also," asks M. Guyot, "what will happen to the British inventor if Italy, Switzerland or Belgium, for example, take a leaf out of the British Statute-Book, and insist that, if an English patent is to be recognised in those countries, it must be 'exclusively or principally' worked in them? 'Inventors have few enough guarantees already. The Patents Act deprives them of some of these.'"

E

ELECTRICITY SUPPLY IN NORTH LONDON.

It is not many years since the British Electric Traction Co. invaded, and proceeded to stretch itself out in, North London, the results of which are visible in the acquisition of tramways and the creation of an electricity supply business. One of the progeny of the B.E.T., by which it is controlled, is the North Metropolitan Electric Power Supply Co., which was incorporated by Act of Parliament in 1900 with power to supply in bulk over an extensive area in North London, and has been steadily plying its trade and simultaneously increasing its original powers with satisfactory results, the object, doubtless, being to obtain as much as possible of the "distribution" within its area, which enhances the value of the bulk supply and assists more or less to render its insidious and tentacular network unassailable. And it has been, and is being done, by the unfortunately dwindling electrical Crœsus and its satellite in a manner so innocently artless and simple, so nice and refined, which, of course, are ever the most charming and erstwhile transcending characteristics of the peculiar wont of the B.E.T.; and not without hope of reward either, for is there not a distant glimmer of superannuation to sustain even the pessimistically inclined?

The North Metropolitan Electric Power Supply Co. was promoted possibly somewhat for the benefit of the electric supply business in general within its wide and scattered area, and more for the acquisition of gain in particular, though the latter may be a mere unimportant detail, for what does it matter about profits?

The early days of the company were not marked by any features of more than passing importance, though the fight between the promoters and the various Councils whilst the Bill was being pursued in Committee, is within easy recollection. The first stroke of business in order to enable it to comply with the obligations of the Act of 1900, was probably to purchase from the North Metropolitan Electrical Power Distribution Co., Ltd. (which distributes at Hertford, under an order transferred to that company by the Hertford Corporation), its power station at Hertford, the Distribution Co. being a subsidiary of the Electrical Power Distribution Co., Ltd., which in turn was of the B.E.T. Here may be an interesting question as to the position of the local Corporation, owing to the station being owned by the Supply Co., and the distributing network by the Distribution Co. The Supply Co. then began to supply in bulk to the Distribution Co. for the purpose of the Hertford order, the directors of both companies being nominated by the B.E.T. From Donington House the North Metropolitan Electric Power Supply Co. transferred its headquarters to Evelyn House, the B.E.T. apparently disposing of its interest therein to the Metropolitan Electric Tramways, Ltd., another subsidiary of the B.E.T., which probably gave the latter a profit.

But before this time the B.E.T., or the Supply Co., or both, were exerting their energies in a successful endeavour to capture Willesden. The Willesden Urban District Council had obtained an order and erected a power station of its own at Taylor's Lane, where it was then generating current for the requirements of its order.

There was much commotion at the time; but thus it was, without relating any of the then current episodes, that the Willesden Council parted with a most valuable asset to the North Metropolitan Electric Power Supply Co. A Bill was promoted which, *inter alia*, authorised the Willesden Council to sell, and the company to purchase, the station. It was, of course, a natural and inseparable condition and corollary that the Supply Co. should supply the Council in bulk. The company merely stepped into the position of the Council in regard to the payment of the sinking fund and interest, the Council stipulating for a mortgage upon the property until the debt for which it had made itself responsible was extinguished. Upon the sale of the company to the Metropolitan Electric Tramways, Ltd., by which it appears to have been subsequently financed, it was necessary to explore and develop other grounds. As the Metropolitan Electric Tramways was then reconstructing the lines, which it had purchased from the North Metropolitan Tramways Co. under agreements with the Middlesex County Council, to be worked in conjunction with the light railways to be constructed and arranged to be leased by the M.C.C. to the Tramways Co., it was, of course, essential that the parties to these arrangements should find electrical energy, and it was ultimately mutually arranged to utilise the services of the ready-made and already-owned North Metropolitan Electric Power Supply Co. for the purpose, the directorate of the Tramways Co. being then the directorate of the Supply Co., controlled by the B.E.T. A large generating station was built at Brimsdown, as well as transforming stations at convenient points of the tramway and light railway system, the M.E.T. purchasing its current from the Supply Co.

Another re-arrangement was effected by the Distribution Co. taking a bulk supply from the Supply Co. for the purpose of distribution at High Barnet.

The Distribution Co. is also distributing at Enfield and St. Albans, and, of course, takes a supply in bulk from the Supply Co. for the purposes of the Enfield and St. Albans orders.

The Distribution Co., the issued capital of which is, we believe, owned by the North Metropolitan Electric Power Supply Co., and which, as we have seen, is working orders at Hertford, High Barnet, Enfield, and St. Albans, owns orders for a number of other places within the sphere of influence of the North Metropolitan Electric Power Supply Co.

The St. Albans and District Electric Supply Co., Ltd., which is yet another link in the B.E.T. promotions, and which has now been interred by way of voluntary liquidation, transferred the Order which was transferred to it by the St. Albans Corporation to the North Metropolitan Co., the B.E.T. having apparently previously sold its interest in the St. Albans Co. to the Supply Co.

We thus see that the North Metropolitan Electrical Power Distribution Co. is controlled by the North Metropolitan Electrical Power Supply Co., which in turn is controlled by the Metropolitan Electric Tramways, Ltd., all these companies being under the final control of the B.E.T.

It may be added that the Birmingham and Midland Tramways, Ltd., another subsidiary of the B.E.T., has during the year acquired a controlling interest in the Shropshire, Worcestershire and Staffordshire Electric Power Co.

The B.E.T. is, of course, very fond of controlling powers. With the B.E.T. in the North of London, and the South Metropolitan Electric Tramways Co. in the south (another flotation of the B.E.T.), really it would not be surprising to hear of their making a bid for the L.C.C. tramways, which somewhere "come between."

THE TRAMWAY STRIKE IN SYDNEY.

By E. KILBURN SCOTT, A.M.Inst.C.E.

The strike of drivers and conductors on the Government-owned tramways in the State of New South Wales, which started on Friday morning, July 24th, gave promise of developing into a serious labour disturbance.

The number of tramcar men who came out was about 4,000, and the tramway services affected were those of Sydney and suburbs, Newcastle and Broken Hill. The first is an electric service, and the other two are steam services.

The Sydney system serves an area which is, roughly, 13 miles by 11 miles, having a population of a little over half-a-million. There are about 700 cars in operation.

On account of the ramifications of the harbour and the excellent steamboat services, many people are able to travel between home and business without using the cars, but even so during the last financial year the tramways carried over 150 million passengers, and during a week of seven days nearly six times the entire population.

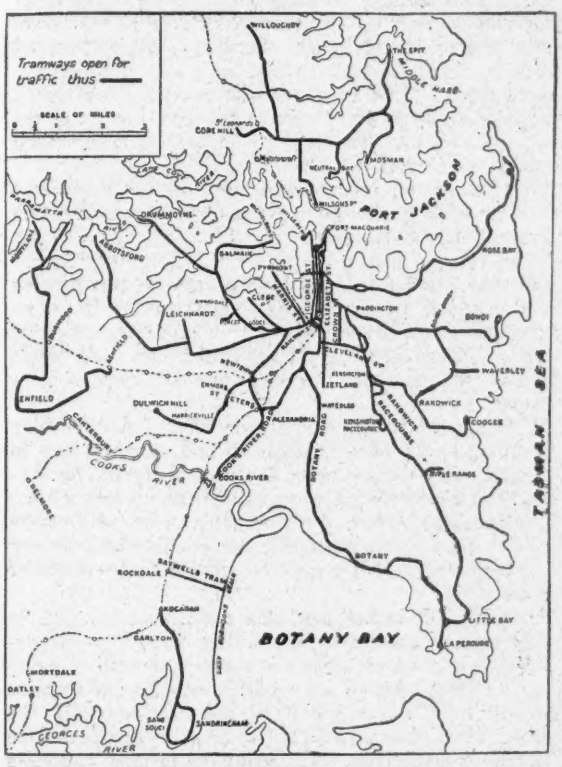
The tramway employés of Sydney had been spoiling for a fight with the authorities for some months, their principal grievances being the espionage system and the delay in providing glass fronts to the cars for the protection of drivers.

The strike was precipitated on account of Conductor Croucher being dismissed from the service on the charge of having sold two tickets which had already been used.

It should be mentioned that when a fare is paid, a coloured and numbered ticket is given to the passenger, and at the completion of the journey this is supposed to be destroyed. As a result there is much untidiness and a chance of tickets being used twice.

Conductor Croucher's cash fare irregularity was discovered in this way; two special constables in plain clothes purchased tickets on the Dulwich Hill line, and having made records of the numbers on the tickets, the number of the conductor and the car, and the time, they sent the tickets into the head office. On comparing them with the running journals, it was found that the two tickets had consecutive numbers, and had been originally issued by another conductor on the previous day.

It should be mentioned that the two constables did not know that an irregularity had taken place, and further, they were not informed that they were to travel on the Dulwich Hill line until the previous night.



Map of Sydney (N.S.W.) Tramways.

Of necessity the charge against Croucher could not be made until the running journals had been examined, which took several days, and then he positively denied issuing the tickets on the dates named. As an explanation, he suggested that the constables must have become possessed of the tickets by picking them up in another car, or in the road His Trade Union preferred to take his word rather than the sworn evidence of the two constables, and the case was therefore heard before the Tramways Appeal Board, and afterwards an appeal was made to Mr. Richardson, Assistant Tramway Commissioner. The Chief Commissioner, Mr. Johnson, late of the Great Northern Railway, England, severely cross-examined the two constables, but finding no flaw in their evidence, the appeal was dismissed.

The Chief Commissioner, however, stated that in view of Croucher's previous good character, he would be afforded an opportunity of applying for re-admission at the end of six months. He admitted that the present espionage system was faulty, and said he was prepared to consider any suggested modifications.

When the result of the appeal was made known to the Tramway Union, a vote was taken as to whether there should be a strike or not, and it was overwhelmingly in favour, but it is only fair to say that the ballot was not a secret one, as each member had to sign his name, grade, and address, on his voting paper.

It has been suggested, with some reason, that if there had been no signing of names, the voting might have gone the other way.

The strike commenced about ten o'clock in the morning of July 24th, and the cars were left in the streets, without anyone to look after them, as a result of which several were tampered with. About 5,000 people collected, and when inspectors and other officials started to run the cars into the car-sheds, the crowd got out of hand.

The electrical Trade Union did not call its members out, but there was a misunderstanding owing to some of the men being asked to drive cars, and refusing to do so. The sub-station attendants are mostly non-unionists, and at a meeting they decided that they would not come out, but if they were asked to do other than their ordinary work, they would probably reconsider the position.

When combined action is taken by large bodies of men, interesting sidelights are thrown on economic and political questions. For example, in this case the strike executive acted quite independently of the accredited Labour Members of Parliament. Indeed, Mr. McGowen, the political leader of the Labour Party, appears to have been taken by surprise.

In Sydney there is a large building known as the Trades Hall, which was erected by the Government during the O'Sullivan *régime* to house the offices of the various Trade Unions. It was from there that the strike was conducted, and what the community was really faced with was a revolt of organised labour in which the Tramway Union only occupied the place of a unit acting under the direction of the central authority.

After the great maritime strike of 1891 the workers of Australia came to the conclusion that the best thing to do was to form a strong Labour Party in Parliament. Payment of members enabled this to be carried out, and at the present time there are practically only two parties in Parliament—namely, Liberals and Labour.

It is claimed that since the formation of a strong Parliamentary party, Labour has practically had the controlling voice in legislation, and certainly the present Railway Act under which the Railways and Tramways are administered by three independent Commissioners, was placed on the Statute Book with the Labour Party's concurrence.

Now, in the tramway dispute a certain number of the employés controlled by the Commissioners struck because they objected to certain rules of administration and wanted to lay down rules of their own.

To gain these ends the political Labour Party was thrust on one side; the Trades Hall party took sole control.

It should be noted that the Sydney tramways are national property, and all the conditions from the Socialist point of view are perfect. The administration of the trams is in the hands of men appointed and paid by Government, and all the people of the State control the Government because of universal suffrage.

The fact, therefore, that there can be a strike such as the present one, shows that State control is not the panacea of all evils connected with industrial business that the Socialist would have people believe.

People at home might bear this in mind, and Labour Members of Parliament may learn something of this ignoring of the N.S.W. Parliamentary Labour Party by the Trades Hall executive.

If Trade Unionism combined is to be a power above Government, then duly constituted legal authority comes to an end. Everything points to this being the crucial question and, therefore, the matter is of very general interest.

The N.S.W. Arbitration Court, which sounds so well in theory, has practically become a dead letter, because many of its awards have been ignored, and now the Industrial Disputes Bill has come in for condemnation, and its repeal may be one of the planks of a general strike.

Sheffield and "Wire" Lamps.—The electric supply department has prepared a striking leaflet dealing with the new metallic-filament lamps, for which it would appear the Sheffield supply is peculiarly adapted.

REVIEWS.

Die Gleichstrommaschine. By Dr. E. Arnold. Vol. II, Konstruktion, Berechnung und Arbeitsweise. Second revised edition. Berlin: Julius Springer. Price M.20.

The revised edition of the first volume of this book was favourably reviewed in these columns a year ago, and this second volume, dealing with the practical construction and calculation of direct-current machinery, is fully up to the mark of the first. It is divided into three parts, dealing respectively with the construction, the calculation, and the operation of direct-current apparatus, including the latest forms of compensated turbo-generators, and commutating-pole variable-speed motors. Dr. Arnold's methods have now been known and appreciated for many years, especially in connection with the commutation problem, and in this book the application of these methods to practical dynamo design is set out in great detail, and with conspicuous clearness.

Chapter 1 gives a useful *résumé* of the existing knowledge of the various insulating materials. Chapters 2 to 7 deal with the construction of armature coils, armature cores, commutators, brush gear, magnets and magnet coils. Chapter 8 discusses insulation testing and mechanical balancing; and Chapter 9 deals with bearing construction. In Chapter 10 fairly full particulars and dimensions of 27 modern machines are given, including a turbo-generator by the Oerlikon Co. for 500 kw., 500 volts, 2,000 r.p.m., one by Messrs. Brown, Boveri & Co., for 250 kw., 500 volts, 3,000 r.p.m., and one by the Ges. für Elek. Industrie, Karlsruhe, for 65 kw., 115 volts, 3,000 r.p.m. Chapter 11 discusses the procedure to be followed in determining the best type of machine when starting a new design to meet given conditions. Chapters 12 and 13 deal with the preliminary determination of the chief dimensions; and Chapter 14 with the commutation conditions, commutating poles, shapes of pole-pieces, &c. Chapter 16 gives the calculations necessary to determine the proper mechanical strength for the various parts. In Chapter 17 the various formulæ used in carrying out a complete design are brought together in tabular form, and the corresponding numerical values for some 30 or 40 machines described in the book are collected.

The remaining 13 chapters deal with special applications of direct-current motors and generators and apparatus connected with them, such as starting and regulating resistances, field-breaking switches, the parallel connection of generators, train-lighting dynamos, Thury motors and generators, boosters, three-wire balancers in the form of motor-generators, and in the form of choking coils, &c.

The treatment throughout is so detailed and complete, that an enormous amount of figuring appears necessary in designing the simplest machine. A little examination shows, however, that this is chiefly due to the fact that the author has everywhere tried to meet the requirements of the beginner in design, whilst the more experienced designer, working from existing standards, is able to omit a large part of the work.

The illustrations are good, and include 13 full-page plates on the same lines as Arnold's well-known sheets. The index is hardly full enough for a reference book.

Practical Induction Coil Construction. By J. Pike. London: Percival Marshall & Co. Price 1s. net.

This latest addition to a deservedly popular series of practical manuals consists, in the main, of a reprint of matter which has already appeared in the pages of the *Model Engineer and Electrician*, and will appeal, as no doubt is intended, rather to the amateur electrician with a home workshop than to the practical coil-maker. It is on this assumption that one or two of the criticisms which follow are based.

Chapter I, dealing with the source of current in the shape of primary batteries or accumulators, is brief, but, nevertheless, instructive to the amateur in its discrimination between volts, amperes, and number of cells. We note, however, that in advising the use of an ammeter for measuring the primary current, no particular stress is laid upon the type of instrument most suitable for the purpose, a fact which is calculated to mislead the reader who is unacquainted with the peculiarities incidental to measuring an interrupted unidirectional current.

The general specification for spark coils in Chapter II serves as a fitting introduction to the subsequent pages, commendable features being the two sectional diagrams, figs. 3 and 4, which give a very good idea of the general proportions of each of the several components of such a coil. The instructions for the preparation of the core of iron wires are particularly clear, and should prove of great assistance in what is undoubtedly one of the most tedious processes connected with coil construction.

In the subsequent chapter on winding the primary, we note the retention of the somewhat out-of-date method of securing finishing turns and ends of layers by tieing and stitching; a simpler and far more satisfactory method is that adopted in all modern coil-winding shops, of interlacing the last few turns of each layer with three or more binders of silk ribbons, or sarcenet, which, suitably manipulated in and out of the finishing turns, renders the coil self-binding, and adds nothing to its bulk.

Chapter VI, dealing with the commutator, would be of greater assistance if dimensions were included; the mode of construction conveyed in the sketch is perfectly clear, but leaves the reader in doubt as to suitable sizes for his component parts. The same remarks apply to the second paragraph on page 43, describing the construction of the discharging pillars. The context is rather vague, and would be the better for a sketch illustrating the idea.

In view of its important bearing on the subsequent behaviour of a spark coil under current, Chapter VIII on "Breaks" might be elaborated with advantage. Apart from the very casual reference to "Vril" and "Apps" breaks, the description that follows of the mercury dipping break designed by the author is rather difficult for an amateur to grasp, the accompanying illustrations affording but scant assistance, whilst some confusion arises out of the alternate references to two or more figures differently lettered.

With the subsequent chapters on winding and finishing the secondary we have no fault to find, save, perhaps, in connection with the testing of the various sections for continuity, which, in view of the possibility of an intermittent break, is better performed with a Wheatstone bridge when available, than by simply testing for circuit with a battery and galvanometer, due regard being paid to steadiness of balance.

Chapter XIV, embodying some useful data relating to actual coils constructed by the author, should prove particularly useful in enabling the prospective coil owner to select a type suitable to his needs. Chapter XV contains some useful photographic hints for radiographers, whilst the subsequent chapter on "Repairs" should be of service to those who possess faulty coils. Altogether the manual represents good value for the money.

Swimming Gala.—On September 22nd the second swimming gala of the County of London Electric Southern Athletic Club was held at the Wandsworth Baths, when a most successful programme was got through. Mr. C. P. Sparks, the president of the club, was present. The first race, a 1-length breast-stroke handicap, was won by a touch by Mr. H. B. Johnson; Mr. J. Smith was second, and Mr. B. Burrow third. The second race, a 100-yards inter-departmental scratch race for a prize given by the vice-presidents, was won easily by Mr. E. C. Midwinter, of the Wandsworth generating staff, Mr. L. B. Bennett, Wandsworth distribution staff, being second, and Mr. W. Shergold, of the City Road generating department, third. The third race, a 2-lengths' handicap, was won by Mr. E. D. Hatch, Mr. J. W. Holliday being second, and Mr. H. B. Johnson third. There was a close finish. The event of the evening was the invitation team relay race, in which teams from Barnes, Battersea, Fulham, City Road, Richmond, London and Wandsworth electric light stations took part. The final of this race proved very exciting, Richmond just winning from London Electric, and Wandsworth being third.

The Wandsworth Swimming Club kindly contributed to the programme with an excellent display of diving and a polo match, Wandsworth S.C. *v.* Newts S.C. Result, Wandsworth S.C. 3 goals, Newts S.C. 1 goal. The "Hunt the Duck" caused considerable amusement, the duck, Mr. L. P. Bennett, being finally caught by Mr. A. West. The entertainment concluded with an obstacle race, which was won by Mr. L. P. Bennett.

BUSINESS NOTES.

Consular Notes.—ARGENTINA.—The Austrian Consul at Buenos Ayres, in a recent report, states that the imports of porcelain insulators into Argentina in 1907 were valued at 68,000 pesos gold. The trade is almost wholly in the hands of British and German houses. It is anticipated that in coming years the demand for this class of goods will greatly increase. In electric cables, competition is very keen between Great Britain and Germany; the agents of the supplying firms are in many cases the contractors and capitalists for the works carried out. The imports in 1907 were valued at 2,771,000 pesos gold. Incandescent lamps are for the most part imported from Germany, that country having taken a great interest in the electrical trade of Argentina; the value of the imports in 1907 was 88,000 pesos gold. Carbons are imported chiefly from Germany and the United States, the value of the imports in 1907 being 40,000 pesos gold.

SWEDEN.—The Austrian Consul at Gothenburg, in a recent report, states that large electrical works are at present in course of construction in that town. The works are in communication with the large central at Trollhatten. The large electric power station at Trollhatten will be one of the largest and most important plants which has been constructed in the country up to the present. It will be carried out at the cost of the State by the Trollhatte Kanal und Wasserderektion, and it has so far advanced that hopes are entertained of its completion by the end of 1909. The plant is intended to utilise the water-powers of the Trollhatten Fall with a power of 76,000 H.P. The power station will be erected for eight turbines, each of 10,000 H.P. In the contract which has been entered into by the Kanalwerk and the Municipality of Gothenburg, it is determined that the Kanalwerk shall supply electrical energy to the town (72 km. away) in the form of 6,000-volt, 25-period, three-phase alternating current. The water power of the Gota Elfs is not limited to the present capacity of the Trollhatten Falls. By the regulation of the outflow of the Vener Lake, a further power of 61,800 H.P. can be produced at Trollhatten. By appropriation of the Vargon Fall above Trollhatten, a further 20,200 H.P. can be produced, and by appropriation of the Lilla Edet Fall below Trollhatten, an additional 22,300 H.P. So that it is possible to obtain a further power of 105,000 H.P. in all, and it is very probable that the Reichstag will arrange for the utilisation of this further power in the present year. The electric energy thus produced will be utilised partly for industries, and partly for railway purposes. For the latter purpose, 20,000 H.P. is to be delivered from the Trollhatten station. In addition to the Trollhatten Falls, the State have purchased other falls in various parts of Sweden, with the intention of utilising them for electric traction purposes on the State railways.

GREECE.—The Austrian Consul at Piræus states that in recent years the imports of machines have shown a tendency to decrease, partly owing to a lower rate of exchange, and partly to the keener competition on the part of the home industry. As regards the larger steam engines and turbines, Swiss works have secured the greatest share of the trade for some years; small steam engines are usually made in the machine works and foundries at Piræus. Gas engines are supplied exclusively from England and Germany, but English preponderate in consequence of their much cheaper price. Suction-gas engines are being imported in greater quantities. There is no demand in Greece for explosion motors of other kinds, such as petroleum and benzine motors, on account of the fact that petroleum and benzine are so dear. Petroleum is a monopoly of the Government, and costs 1 fr. per kilog. Benzine, as a result of the cost of transport and a duty of 10 centimes per kilog, costs 60 centimes. The adoption of spirit motors, using spirit produced in the country from currants, is being taken in hand, and promises success. In recent times a machinery firm have introduced several locomobiles for pumping purposes, with good results.

ITALY.—Reporting on the electro-technical industry of Milan, the Austrian Consul in that town states that this industry is divided into two distinct sections, the one engaged in the production and distribution of electric power, and the other in the construction of electrical material. On December 31st, 1906, the hydraulic power included in concessions, or in private property, amounted to 830,000 H.P. To this figure must be added 210,000 H.P. produced by thermo-electric works (works with steam, gas or petroleum power), and utilised by the hydraulic works mentioned, for purposes of reserve power, but also actually in working for the production and distribution of electric power. It appears from the reports of Italian electrical undertakings that the working capital per electric horse-power varies between 4,000 lire and 400 lire, or an average of 2,200 lire, whilst the average price varies between 60 lire and 300 lire, or a final average of 180 lire. The total capital invested in electrical undertakings is estimated at 500 million lire. The smallest undertakings have shown good financial results. A summary revision of all the balances of the most important electrical works for the years 1904, 1905 and 1906, show an average profit of 3·4 per cent. per annum. In spite of the strides which have been made in the electrical industry, Italy is still a good market for German, Swiss and Austro-Hungarian goods. The imports of material for electrical industries in 1895 amounted to about 4 million lire, but during the last 10 years it has increased to 15 million lire, whilst the home production per annum has increased during this period from 2 million lire to 8 million lire. The latest statistics as to the utilisation of electric power in factories, workshops, &c., are for the year 1905. The consumption of electrical energy in 1895 amounted to 161 million KW.-hours, and by 1905 this had increased to 621 million KW.-hours. The number of works paying tax in 1904-5 was 4,831, of which 1,382 were in Lombardy and 1,109 in Piedmont. Thus these two provinces possess one-half of the total number of works, apart from the fact that the works in these provinces are the most powerful. Electro-technical apparatus, particularly small material for electric lighting plants, are imported chiefly from Germany. In Italy itself a beginning has been made in the manufacture of such goods with success so far as concerned the class of goods the production of which is easy, and in which a high duty is levied. Insulators and other porcelain goods as well as glass reflectors for electric lighting purposes are supplied by Bohemia. Austria supplies arc light carbons and table lamps. The trade in incandescent lamps is important, and is chiefly in the hands of France, Switzerland and the United States.

Reporting on the railways the Consul states that a very interesting development is the utilisation of electricity for traction purposes. Italy, a land without coal, is very rich in water power; it is, therefore, natural that electric current should be adopted for railway purposes. A beginning was made on the line from Lecco to Sondrio with the branch from Colico to Chiavenna, and this system has also been installed on the line from Milan to Varese. It was at first intended to run small trains, but this was found to be too expensive. Consequently attempts are being made to secure locomotives which will take trains of the same size as those drawn by steam engines.

Elsewhere in his report the Consul states that gas engines are produced in various works. Nevertheless, many gas engines are imported from abroad, particularly from Germany, England, Switzerland and Austria. The home production has, however, considerably increased. Dynamo machines are now being produced in larger quantities, but the importation, particularly of the smaller machines, is very large. A decrease was shown in 1907 in the importation of the larger machines.

JAPAN.—The German Consul at Kobe, in a recent report, states that calcium carbide is one of the many articles of trade with Japan in which foreign competition has been almost eliminated by a cheapened home production. According to the trade statistics, the imports have decreased from 32·442 kilogs., valued at M. 12,884, in 1905, to 360 kilogs., valued at M. 275, in 1906. In the spring of 1906 the Japanese Carbide Co. was formed in Tokio, with a capital of M. 1,200,000, and installed turbine plant on the Soki waterfall, near Kagoshema, with a power of 10,000 H.P. The production of the carbide by this means was found to be so profitable that the competing works at Sendai and Nagaoka and in the Province of Shinano could be bought out. The company propose, in coming years, to considerably extend their works on the Soki falls and to export their product to Europe. The demand for carbide in Japan is stated to be 90,000 kilogs. monthly, 20,000 kilogs. each being used in Tokio and Osaka alone.

The German Consul at Nagasaki reports that in 1907 the imports of electric motors showed an increase as compared with previous years. The Mitsu Bishi Co. have latterly undertaken the construction of these motors. The imports of cranes also showed an increase. In Nagasaki these are exclusively British or American, but in Moji they are two-thirds German. Although the Mitsu Bishi Co. have made arrangements for the production of steam turbines for vessels, turbines have so far been imported from the United Kingdom.

Errata.—In our table of German electrical exports, on page 514 last week one or two errors occurred. In the section relating to dynamos, &c. (above 5 double centners), the 1907 figure to other countries should have been 14,800, not 4,800, and the increase 6,800, instead of 16,800. The 1907 total is correct as it stands, but the increase total is 53,000, not 43,000. The last line of figures in the cable section, reading from left to right, should be 19,300, 41,700, + 22,400. Incandescent lamps to Italy: the increase should be 230. Electrical measuring instruments to other countries should show an increase of 400.

Catalogues and Lists.—MESSRS. J. H. HOLMES AND Co., Portland Road, Newcastle-on-Tyne.—Two new lists, one giving illustrations and notes concerning a variety of their Universal electric light fittings for use on board ship, and in workshops, factories, &c.; the other, giving illustrations with description and tabulated sizes and outputs of the Holmes-Clayton two and three-phase motors of squirrel-cage or slip-ring types, 4, 6, 8 and 10 poles respectively.

THE STIRLING BOILER CO., LTD., 25, Victoria Street, S.W.—Pamphlet giving details of tests carried out on the Stirling boiler under a variety of conditions—hand-fired, with chain-grate and Underfeed stokers, with oil, wood, peat, coke-oven and blast-furnace gas—and in many places, at home and abroad.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton.—New leaflet ("K") giving illustrations with a table of sizes and prices of their "Magnet-Juno" and vertical carbon flame lamps, also new clutch type and open-type arc lamps. Copies of the list may be obtained on application.

BRITISH INSULATED & HELSBY CABLES, LTD., Prescot.—A number of illustrated leaflets in their usual style, as follows:—Nos. P64, 66, 69, 70 and 74 dealing with house-service boxes; No. P65 relating to four-way boxes; P68 dealing with Prescot fuse wire, and P71 concerned with the Prescot pillar.

UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—List No. 1,403, containing particulars of a variety of their resistance apparatus for arc lamp circuits, including adjustable line resistances for D.C. and A.C. circuits, and arc lamp starting resist-

ances. Dimensional drawings are given, also prices, code-words, &c. List (NE111) for 1908-9 season giving particulars of carbons for Excello and other patterns of flame arc lamps; also No. 1,406 giving illustrated information, prices, code-words, diagrams, &c, of "Union" auto or economy coil transformers for arc and metal-filament lamps. The latter list is an enlargement of the previously issued transformer list.

Electric and Ordnance Accessories Co., Ltd., Birmingham.—Circulars relating to the Warner auto-meter, a speed indicator and odometer for motor-cars, and to H.T. and L.T. insulators.

The Metallic Seamless Tube Co., Ltd., Wiggin Street, Birmingham.—Pamphlet (A 8) containing particulars with illustrations and prices of their lampholders. The new Automat interior, of which we gave details in our last issue, is fully dealt with. We understand that many orders have been received for these devices. The company are now developing the application of the principle of automatic connection to other forms of electrical accessories, such as ceiling roses, fuseboards, &c. Copies of the list may be had on application to the company's head office or branches.

The A.E.G. Co. of South Africa, Ltd., Caxton House, Westminster, S.W.—Two of their sectional publications: one giving illustrated particulars and prices of their electric ceiling fans for continuous and alternating current; the other tabulating sizes and prices of, and giving information concerning, resistances for intermittent service controllers.

Electrical Power Storage Co., Ltd., 4, Great Winchester Street, E.C.—Pamphlet containing a description of the company's exhibit at Manchester.

Schiersteiner Metallwerk G.m.b.H., Schwerinstr, 3, Berlin, W., 30.—Leaflets illustrating their instruments for measuring the length of wire, cable, &c., as it passes between a pair of rollers; "Long" clips for letters; hot-wire switch for electrical advertising signs; and mercury-tube switches for maximum or minimum cut-outs, &c.

Messrs. Bagshawe & Co., Ltd., Dunstable Works, Dunstable.—Leaflet illustrating their chain drives with friction clutch.

Electric Motive Power.—The London Electric Firm, George Street, Croydon, send us a photo. of one of their workshops, showing the electric motor installed on a bracket on the wall, thus taking up no floor space. This is a 5-H.P. motor, and drives about 15 machine tools, including universal milling machines, universal grinding machines, lathes (mostly 7-in. and 8-in. centres), drilling machines, hack saws, &c. The cost for energy for driving this particular motor has amounted to about £40 for the past 12 months, working on every week-day during the whole year, with energy at 1½d. per unit and 5d. during the peak hours. This result shows remarkable economy. If the motor had been running at full load for 300 days, 9 hours a day, the cost of energy at 1½d. per unit only would have been over £80.

Motor-Car Exhibition at Olympia.—The autumn exhibition of motor-cars at Olympia, under the auspices of the Society of Motor Manufacturers and Traders, has been fixed for the period November 13th to November 21st. The show will be confined to racing, touring and pleasure cars and accessories, and a separate exhibition for commercial vehicles and motor-boats will be held next spring. The principal novelty at the coming exhibition will be the new type of "4-in." touring cars which have taken part in the Isle of Man race, but there will also be several new departures in engine design. Over 300 firms have entered their products, and the whole of the space in Olympia and its annexe will be completely occupied.

Book Notices.—*The Slide Rule.* Eleventh edition. Price 2s. *Logarithms for Beginners.* Second edition. Price 1s. By C. N. Pickworth. London: Whittaker & Co.—Mr. Pickworth's manuals are so well known and appreciated that we need do little more than announce their re-issue. *The Slide Rule* has been reset in new type throughout, revised and extended in various respects. The clear exposition, useful tables, and numerous examples given render this a most useful handbook. "Logarithms for Beginners" is re-issued with corrections and revisions where necessary. It contains all that it is generally necessary to know in order to make calculations with the aid of logarithms.

Thoughts on Natural Philosophy. By A. Biddlecombe. London: Whittaker & Co.—In this pamphlet the author speaks of force as energy, and of energy as "material motion"—whatever that may be. Electricity and magnetism do not escape, and we learn that they are material motion in special forms. Motion and speed are the catch-words of this treatise, and the theory that the energy output of radium is due to particles expelled at inconceivable velocities has seized the author's imagination; he ascribes the diverse characters of all kinds of matter to differences of speed, weight (*sic*) and movement, though he denies the existence of gravitation.

The British Chamber of Commerce of Turkey, quarterly trade journal, published at Constantinople, Sept. 15th. This pamphlet contains a good deal of general information relating to trade and commerce with Turkey, which it might be useful for our readers to study.

"Atti della Associazione Elettrotecnica Italiana." Vol. XII, No. 3. May and June, 1908. Milan: Rebeschini di Turati & Co.

"Power Railway Signalling." By H. R. Wilson. London: Publishers of the *Railway Engineer*. 1908. Price 18s. net.

"Die Elektrotechnik." By K. Landien. Hanover: Dr. Max. Jänecke. Price M. 3·60.

"Molesworth's Pocket-book." The 26th edition of this work, thoroughly revised and enlarged to 910 pages, will be issued on Monday next, price 5s. net.

"Alloys (non-ferrous)." By Prof. A. Humboldt Sexton. Manchester: Scientific Publishing Co. 1908. Price 7s. 6d. net.

"Proceedings" of the Incorporated Municipal Electrical Association, 1908. London: Wyman & Sons. Price 5s.

Advice to Japanese Traders and Would-be Travellers.—Our contemporary, *Engineering*, gave the following interesting advice to merchants trading with Japan, a week or two ago:—

"British merchants have been so long accustomed to a practical monopoly in many departments of trade that they do not observe that new conditions are arising which demand new arrangements and higher qualifications. A very little experience in the Far East is sufficient to show anyone that, for instance, the German and Swiss clerks and merchants have, as a rule, higher qualifications than the British. They have been through a very complete course of training in a commercial or technical school, and on their arrival in the East they at once begin the study of the language of the country, so that they are able to dispense with all intermediaries in the transaction of business. In his last report, Mr. Crowe, the Commercial Attaché to His Majesty's Embassy at Tokio, impresses on British merchants the desirability of acquiring sufficient knowledge of the vernacular to enable them to dispense with a 'Banto' in their daily transactions. He says that it is very gratifying to find that the energetic Committee of the British Association of Japan have taken the matter up, and have prepared a course of study which, it is hoped, will aid young clerks to attain such a standard of proficiency that they will be able to conduct ordinary negotiations and travel about the country without an interpreter. It is not contemplated that the intricate written character should be studied; a fair knowledge of the colloquial is all that will be required of the student, and it can only be hoped that many will seize this opportunity to improve their own prospects. It is, however, pretty well known that many Germans are not content with this very elementary instruction, but attain a fair knowledge of the Chinese ideographs; and Mr. Crowe says that there is, after all, no reason why the ordinary Briton, in the spare time at his disposal, should not be able to make as much progress in a matter of this kind as his rivals. He remarks that most of the commercial travellers who visit Japan are not responsible representatives of the different makers or firms whose samples they are carrying about. They are usually doing business purely on a commission basis, and any orders they may secure on samples which have been supplied to them, are always subject to specific confirmation by the home firm. In such cases it is doubtful whether the engagements they enter into are legally binding on the principals, unless they carry with them a power of attorney. It is therefore advisable that travellers who are sent out should be specially authorised to do business on behalf of their principals. Inquiries are often received from manufacturers and merchants at home who merely ask for the names of the principal firms handling certain lines of goods in Japan. Except in cases where any special information is required, it would save a good deal of time if the said manufacturers and merchants would apply to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, for the names of the leading British firms in Japan. Most of them have offices in London, and business could be arranged immediately to the advantage of both parties. Otherwise two or three months must elapse before the firms are placed in communication with each other."

Liquidation.—Gould Storage Battery Co., Ltd.—This company, meeting at 25, Regent Street, London, S.W., on September 26th, resolved to wind up voluntarily, as it cannot, by reason of its liabilities, continue business. Mr. E. A. Locock, 164, Coleherne Court, London, S.W., is liquidator. A meeting of creditors is to be held at Regent Street on October 17th at 5 o'clock. Creditors must forward particulars of their debts, &c., to the liquidator by October 31st.

"Knowledge" Calculator.—We have received from the publishers of *Knowledge* a specimen of a new circular slide-rule calculator, designed by Major B. Baden-Powell, and constructed of thick cardboard. The scale is 6⅜ in. in diameter, giving a total length of scale of 20 in. It is not claimed that very exact calculations can be made with this appliance, nor is it particularly novel, as we recall a very similar device in use 18 years ago; but it is very well printed and constructed, and full advantage has been taken of the ample space available to mark numerous gauge-points for useful multipliers inside the circle, so as to facilitate calculations, conversions from foreign to British measures, &c. Being comparatively inexpensive, and very convenient for the writing table, the calculator should prove welcome to many. Instructions for its use are printed on the back.

Trade Announcements.—Messrs. John Wilson & Co. have removed their offices from 49, Lime Street to 39, Lime Street, E.C.

Mr. W. Charlton, late with the Armorduct Manufacturing Co., Ltd., has accepted an appointment with Messrs. Warren, Beattie & Co., Ltd., of Middlesbrough, as commercial traveller.

Glow Lamp Works.—A company has been formed at Bilbao, Spain, for the manufacture of glow lamps, and is about to order its equipment. At the head of the undertaking is Don Francisco Vallejo, of Bilbao.

"Tantalum" Lamps.—Messrs. Siemens have placed a large contract for bill-posting on public hoardings in the provinces and for the display of similar smaller advertisements in the Underground Railway and Tube carriages in London. The picture is one of an evidently satisfied consumer. Engineers who are engaged fighting gas competition, and shrewd consumers throughout the country, will be interested. We understand that a reproduction of this poster in neat show-card form will be supplied on application to Messrs. Siemens Bros. Dynamo Works, Ltd., at 6, Bath Street, City Road, E.C.

LIGHTING and POWER NOTES.

Aberdeen.—The question of a new water supply from the River Avon, at a cost of £1,500,000, will shortly come up for discussion. A suggestion has been made in this connection that the fall of some 2,000 ft. which occurs between the Avon and the city, might, in some way, be jointly utilised for electrical purposes as well.

Ballyjamesduff (Co. Cavan).—The electric lighting scheme for this town is to be proceeded with.

Banbridge.—At the adjourned meeting of the Urban Council on the 21st ult., the question of lighting the town by electricity was again considered. The clerk was eventually directed to furnish Messrs. Wilkins & Burder, consulting electrical engineers, Dublin, with information required in order to make a report on the district. After a prolonged discussion, it was decided to have expert evidence on the matter for the next meeting of the Council.

Barking.—Tenders are to be invited from local tradesmen as well as the Council's electricity department for wiring Creeksmouth School for electric light. The electrical engineer proposes changing the street lamps in Long Bridge Road and fitting the posts for Osram lamps, the result of which, he contends, would be an improved light and a deceased cost. The matter is to be referred to a committee of inquiry.

Belturbet.—The final details for the electric lighting scheme of this town have been approved of by the Urban Council.

Canada.—The situation in Montreal, as regards street lighting, is apparently unaltered. The company adheres to its offer of $75 per lamp, and, as its existing contract expires in January next, prompt steps are required to arrange matters. The existing cost to the city is $123,669, as compared with the proposed figure of $152,803. It has been pointed out that another offer of the company to supply energy for lighting public buildings would effect a saving of 10 to 15 per cent. on the present rates.

Continental Notes.—Switzerland.—The cost of the Government's plans for the utilisation of the waters of the River Barine for electrical purposes totals 1,216,000 fr. Among the items are three 2,000-h.p. turbines and one of 250-h.p., with accessories, 205,000 fr.; three generators and an exciter, 186,000 fr. The works include the raising of the existing river bar 2½ metres, construction of tunnel 288 metres long and 28 sq. metres section, hydro-electric station, &c.

Italy.—According to official statements just made in the Italian Parliament, the new electric installations authorised in Italy in 1907 numbered 226, or 13 less than in 1906. The new generating stations numbered 88 (38 fewer) of a total power of 18,500 kw. The most important of the installations was the station at Isola of the Società Idro-Electrica, of Liguria, which supplies 6,300 kw.

Germany.—An international competition for plans and estimates for a scheme for obtaining water-power from Lake Walchen is invited by the Bavarian Minister of the Interior. Terms and conditions will be forwarded on receipt of 20 marks. Plans, &c., must be sent in by January 20th, 1909, addressed to the K. Obersten Baubehorde. The premiums are three in number, being 20,000, 15,000 and 10,000 marks respectively.

Sweden.—The five large turbines which will, says *Affarsvarlden*, form the first equipment of the Swedish Government's power station at the Trollhattan Falls, will be the largest hitherto employed in Europe. They will be of 10,000-h.p. capacity. Orders for two of these machines have been entrusted to Messrs. Nydqvist & Holm, of Trollhattan, and for two others to the Karlstads Mek. Verkstadsbrank works at Kristinehamn.

Dublin.—At the meeting of the North Dublin Union last week, a letter was read from the Secretary of the Lighting Committee of the Corporation *re* the proposed lighting of the Union with electricity, which had been delayed, he understood, owing to the proposed union between the North and South Unions. The Committee was anxious to know, while not wishing to bind the board, if the latter could decide on the quantity required on account of the urgency for the completion of the North Circular Road extension. Several members of the board expressed their approval of the electric lighting, but the chairman desired a notice of motion on the subject. However, as a deputation of the North Union is to wait on the South Union this week, the matter was postponed till after that.

Dundee.—A rather novel situation has arisen in connection with the lighting of one of the outlying districts, which tends to show the great competition going on at present between the gas and electricity departments. Some time ago Mr. Richardson, the electrical engineer, erected four flame arc lamps, the principal reason being to test the lamps. The new lamps have given universal satisfaction to the shopkeepers and residents in the district. Evidently under the impression that the arc lighting was not sufficiently bright, or, may be, actuated by jealousy, the gas department a week ago suddenly erected some large intensified-gas lamps, practically alongside the arc lamps. With this new development the situation has become quite complicated and has drawn a lot of attention. The result is that a meeting of the Lighting Committee was convened for Monday last on the spot, and it will be interesting to hear the result of its deliberations.

With reference to the further borrowing powers required in connection with the new generating station, notification has just been received from the Secretary of Scotland granting permission to borrow the further sum of £40,000.

East Ham.—The Electric Lighting and Tramways Committee of the B.C. has adopted the suggestion that the scheme recently approved for the supply of electric lamps, &c., to consumers on the hire system should be extended, whereby intending consumers can be supplied with a smaller lamp, viz., a 200-c.p. lamp at 35s. per quarter per lamp; or two 100-c.p. lamps at the same charge.

Elland.—A L.G.B. inquiry was held on September 23rd into the application of the U.D.C. for a loan of £3,000 for electricity and refuse destructor purposes. There was no opposition.

Exeter.—The town clerk has reported to the Electric Light Committee, the sanction of the L.G.B. to the borrowing of £6,420 for mains, and £1,680 for house services, the former for a period of 20 years, and the latter for a period of 15 years.

Fulbourn.—The lighting of Fulbourn Asylum continues to create considerable discussion in Cambridge, and at the meeting of the T.C. on Thursday, the Sub-Committee reported as to a conference between representatives of the T.C., the Cambridge C.C., and the Visitors to Fulbourn Asylum. The report stated that the Chairman of the Visitors finally suggested that the whole question of lighting of the Asylum should be referred back to the Visitors in order that they might procure fresh tenders from the gas and electric lighting companies. This course was adopted, and the Council approved of the Committee's action.

Hull.—The Electricity Committee has received a unique inquiry for a large supply of energy by a firm near the electricity station. A condition made by the firm is that the Committee shall also supply steam power to these works—such a request having never been received by the Committee before. It is, however, prepared to meet the request, if possible, and has offered to supply the steam also if the firm will pay the cost of the necessary pipes to the works—not a long distance—and guarantee to take the electricity and steam power for at least a year. After the recent boom in gas at Hull, electricity for lighting is again coming into favour, and the Committee has recently secured some good customers, one of the chief being the new Post Office, which is approaching completion. The Committee has had under consideration for some time, the fitting out of a showroom for the display of all the latest fittings and appliances in connection with electric lighting, heating and power.

India.—Sir Francis Youngbusband has opened the new hydro-electrical installation at Jhelam, in the presence of the Maharaja of Kashmir. The electrical power is to be utilised for dredging the River Jhelam, and for driving silk factories at Srinagar.

Kingsbury.—The U.D.C., at its last meeting, approved of the chairman's action in calling upon the North Metropolitan Electric Supply Co. to carry out a section of its order as regards the compulsory work to be done by the company. The chairman pointed out that by the terms of the order the company, within two years from August, 1905, could be called upon to supply electrical energy for lighting and for power in all or any part of the compulsory area.

London.—Southwark.—The Finance Committee of the B.C. has decided that application be made to the L.C.C. for sanction to the borrowing of a loan of £8,500, to cover the amount standing against the electricity fund capital account.

Mansfield.—The Health Committee has decided to spend £800 on alterations and improvements at the refuse destructor, with a view to enabling it to deal with a greater quantity of material; the plant is worked in conjunction with the electricity works.

Stirling.—For the year ending May last, the electricity department sold 344,142 units, the revenue amounting to £5,417. The working expenditure amounted to £3,231; the balance of £2,185, together with £74 brought forward, sufficed to meet financial charges and leave a small sum in hand. Some £223 was transferred from revenue to capital account during the year in respect of hire-purchase motors.

Windsor.—Thirty electric lamps were stolen from the standards in Bolton and King's Roads, on Friday morning last. The theft must have occurred directly after the lamps were extinguished. It is understood that some of the globes have been recovered by the police.

Worsley.—The electrical installation recently erected by Messrs. Drake & Gorham for the Earl of Ellesmere at Worsley, includes two 45-H.P. suction gas engines and generators working in conjunction with a 220-cell battery. The engine house buildings are of artistic design, being constructed in half-timber work with leaded glass windows, to harmonise with surrounding buildings. The feeders are laid on the solid system, and run to Worsley New Hall, Lord Ellesmere's residence, where 1,100 lamps and an automatic lift are installed; to Worsley Old Hall, Lord Brackley's house, which contains 210 lamps; also to the farm buildings, some 500 yards away, where, in addition to lighting, a modern roller flour mill, cake, oat and corn crushers, corn dressing and conveying plant, chaff-cutters, pumps, &c., are driven electrically. Coke at 15s. per ton, supplied from Lord Ellesmere's collieries, is used for the gas producers; the entire installation was in the hands of Messrs. Drake & Gorham, Ltd.

TRAMWAY and RAILWAY NOTES.

Bacup.—On September 24th a special meeting of the T.C. was held, when an agreement was ratified with the Rawtenstall Corporation, by which Bacup pays £10,300 for the whole of the Bacup section the of Rossendale Valley Tramways, Rawtenstall lending the purchase money, electrifying the line, working the tramways, drawing the revenue, and, at the end of 30 years, handing over the branch to the Bacup Corporation as a going concern. The Mayor (Ald. J. H. Maden) said Rawtenstall wished to buy the tramways by September 30th, and he understood, from the secretary of the tramway company, that it was in a position to complete by then. In reply to questions from members of the Council, the Mayor said the agreement in no way affected Bacup's electric lighting order and Bacup had not parted with power to work its own tramways. The question of the supply of power would come in upon the report of the L.G.B. with respect to Rawtenstall's application.

Continental Notes.—GERMANY.—According to the *Times* some 16 persons were killed and a number seriously injured, in a collision which occurred on one of the overhead sections of the Berlin and Charlottenburg Elevated and Underground Electric Railway, on Saturday last. The accident is attributed to a motorman mistaking a signal at an elevated triangular junction near the Potsdamer Platz, and apparently both trains, travelling in the same direction, tried to occupy the line, with the result that the first car of one train was pushed over a parapet into a courtyard, some 30 ft. below, the second car being left hanging over. The Prussian Minister of Railways has instituted an official investigation into the accident, and meanwhile the driver of the offending train has been arrested.

It is rumoured that the Allgemeine Electricitäts Gesellschaft, together with the Siemens-Halske Co., has under consideration a project for forming a new company to deal with the electrification of the Prussian railways.

Dundee.—The tramwaymen in the employ of the Corporation are claiming an all-round increase of 1s. per week in wages.

Erith.—The U.D.C. has adopted a report by a Departmental Committee, recommending that the management of the tramways and electricity departments should be amalgamated.

Glasgow.—Some time ago boxes were placed on the Glasgow Corporation cars for the reception of used tickets, and passengers are now making increased use of the receptacles. The number of tickets now put into the boxes each week is about 1¼ millions, although this only represents about 25 per cent. of the total. The total weight of the tickets used by the department in a year is about 108 tons, so that the annual average weight of 27 tons of tickets is being dropped into the boxes.

Hanley.—The town clerk has reported that, in consequence of the opposition of the six Pottery towns to the order promoted by the Potteries Electric Traction Co. and the North Staffordshire Tramways Co. in the House of Lords, an order had been issued by which it is necessary for the consent of the road authority to be obtained, as well as that of the B. of T., to the making of additional cross-overs, &c., and to altering tramway lines. The attention of the Potteries Electric Traction Co. has been called to the necessity of proceeding with the light railway to Bucknall Station.

London.—In a few days' time it is intended to introduce several useful alterations in the working of the Piccadilly, Hampstead and Baker Street tubes, in the shape of more frequent services and faster trains. On the Piccadilly tube a through theatre train will be run from the Strand terminus to Finsbury Park, and on the Hampstead tube a non-stop train which has been run into town in the early morning, has proved so popular, that similar additional trains are to be added.

CHELSEA. — The Highways Committee of the B.C. has recommended the Council not to consent to either of the proposals of the L.C.C. for the introduction of tramways in the borough. The L.C.C. proposes to construct tramways from Battersea Park Road *vid* Battersea Bridge Road, Battersea Bridge and Beaufort Street to King's Road, the object being to provide tramway communication across the river between Battersea and Chelsea. Other proposals are to construct tramways from Battersea Bridge to Shepherd's Bush.

Merton.—The U.D.C. has decided to communicate with the B. of T. unless immediate steps are taken by the London United Tramways Co. regarding the proposed widening of Merton Road. The Tramway Co. states that it has no intention to avoid its obligations, but that there has been a slight deadlock between the owners and the tenant of the property required for the purpose.

U.S.A.—On the 24th ult. a collision occurred between two electric cars on the Philadelphia-Chester suburban line. It appears that a car was held up by fog at the time, and a following car ran into it, the killed and injured being variously estimated at between 70 and 80.

Wallasey.—A meeting of the Wallasey Ratepayers' Association was held last week to discuss the proposal of the Council to extend the tramways to Wallasay Village. It was pointed out that the cost would be £87,000, that a large section of the inhabitants do not want the line, and finally a large vote was recorded against the scheme proposed. A recommendation for a circular route through to Liscard and Seacombe was subsequently passed.

West Fife.—A representative of the firm of J. G. White and Co., London, who have just concluded the construction of the Dalmuir to Dumbarton tramways, has visited Duntermline in connection with the new tramway system for the West of Fife. Now that the necessary capital has been secured it is hoped that the works will be hurried on.

TELEGRAPH and TELEPHONE NOTES.

Africa.—The rates for telegrams to Portuguese East Africa by Eastern Co. *vid* France are now as follows:—Nyassa Co.'s offices, 2s. 8d. for each word; all other places, 2s. 7d. for each word.

Canada.—The Provincial Department of Railways, Telephones and Telegraphs for the province of Saskatchewan has lost no time since its organisation in preparing to give effect to the policy of the Government in regard to the construction of a complete telephone system for the province. The Government's telephone legislation only became law about three months ago, yet already contracts have been let for the construction of 400 miles of long-distance trunk lines; all the necessary poles, wire and other material for these, and for additional lines, have been ordered, and scores of rural companies are in process of organisation throughout the province. In a sparsely settled country such as the Western provinces, there is nothing that will make up for the great distances between people, and make rural life in those provinces endurable, like the telephone.

Indian Telegraph Strike.—The Government has sanctioned an increase in the pay of telegraph signallers, involving an extra expenditure of 5½ lakhs of rupees per annum.

Paris.—The Telephone Administration is erecting a temporary exchange close to the General Post Office, and it is hoped that the building will be ready for occupation by the end of this week. Telegraphic communication with places outside Paris has been restored.

Roumania.—The *Telegraph Age* states that the Roumanian Telegraph Administration is congratulating itself on the financial success of a new scheme, the so-called "telegraphic visiting card." This is an inland telegram which contains only the address and the name of the sender. These telegrams take the place of the congratulatory cards that are obligatory on New Year's Day and similar festive occasions. How popular this movement has become may be gauged by the fact that during the fiscal year just expired, no fewer than 322,060 of these telegrams were dealt with on the Roumanian State telegraph system.

Spain.—During the spring of the present year the German system of wireless telegraphy has been set up at four stations in Spain, situated at Almeria, Melilla, Chamartin and Guadalajara respectively. The two first establish communication between the Peninsula and Morocco, a distance of 200 km., with wave-lengths of 300, 600, 900 and 1,200 metres respectively. At Chamartin waves of a length of 350, 510 and 1,050 metres are employed, and at Guadalajara 600 metres.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Port Arthur-Chifu	Mar. 9, 1904 ..	..
Las Palmas—Arecife	April 18, 1908 ..	Sept. 26, 1908.
Djedda-Sonakim	June 25, 1908 ..	Sept. 28, 1908.
Assab-Massouah	June 28, 1908 ..	..
Kwandang-Menado	Aug. 5, 1908 ..	Sept. 8, 1908.
Cotonou-Lagos	Aug. 28, 1908 ..	Sept. 15, 1908.
Dardanelles-Constantinople	Sept. 20, 1908 ..	Sept. 25, 1908.
Sitia-Rhodes	Sept. 20, 1908 ..	..

United States.—The Postal Telegraph and Cable Co., of America, are constructing new lines between Nevada and California. Work is already well advanced on the section between Goldfield and Tonopah, and will be carried further to Reno, Nev. From the latter point it will be extended over the mountains to Sacramento and San Francisco. A line will also be built *vid* Ely from Goldfield to Salt Lake City.—*Telegraph Age.*

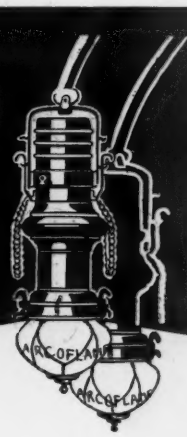
THE . . . .

ELECTRICAL REVIEW.

Manchester Exhibition Advertisement Supplement.

OCTOBER 2, 1908.

SCENE AT STAND Nº 210



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Electric Light is Regulated the same as Gas.

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FOR USE ON EITHER DIRECT OR ALTERNATING CURRENT.

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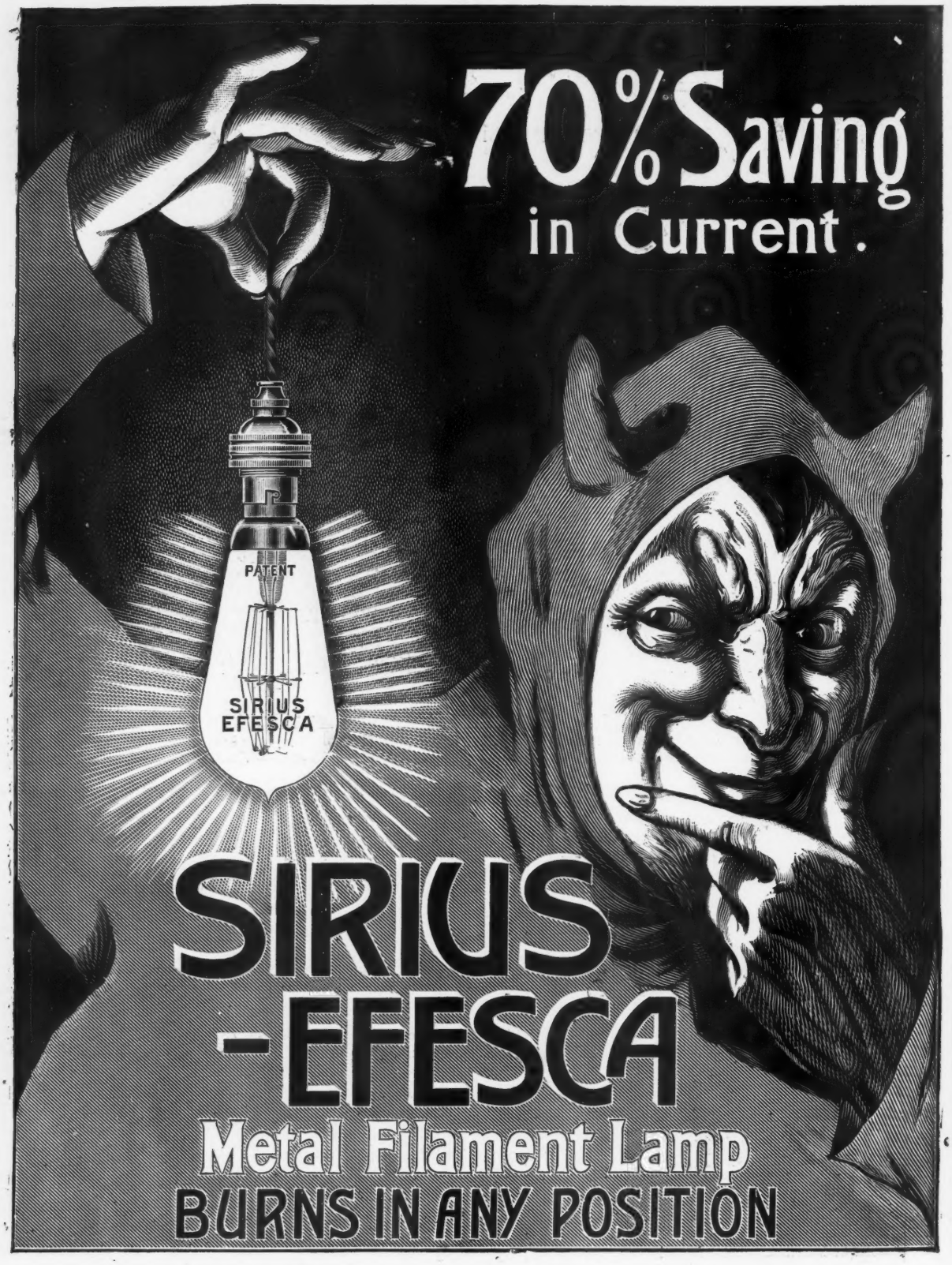

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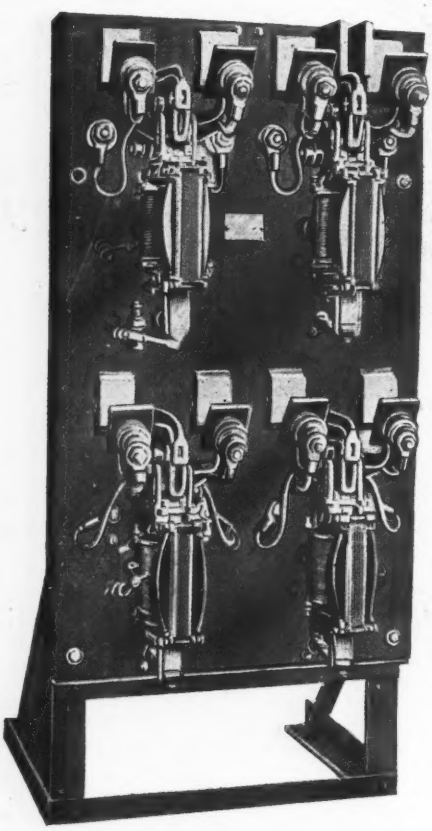
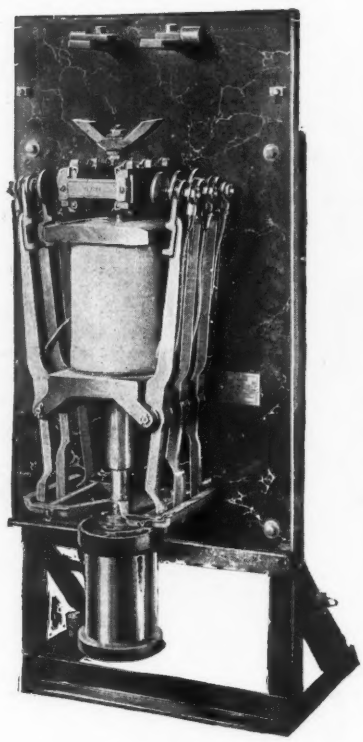


50 H.P. AC OPEN TYPE.
(Pat. 27,000, 1904.)



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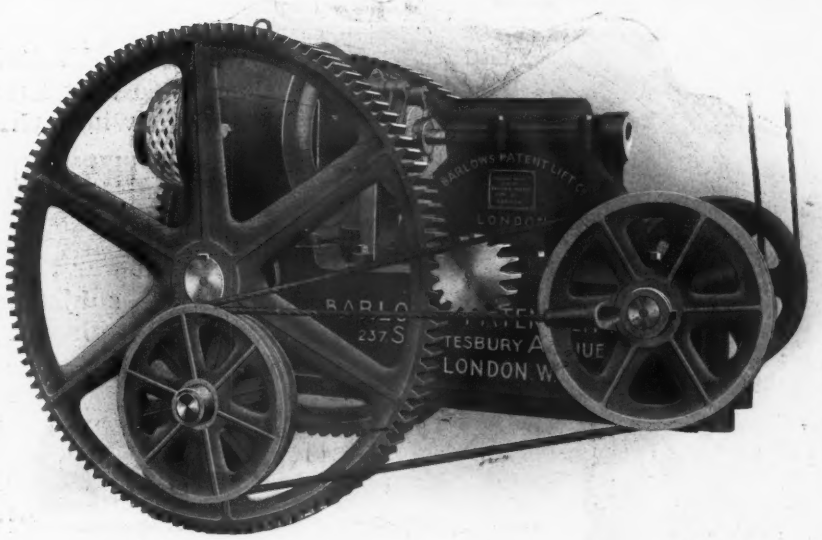

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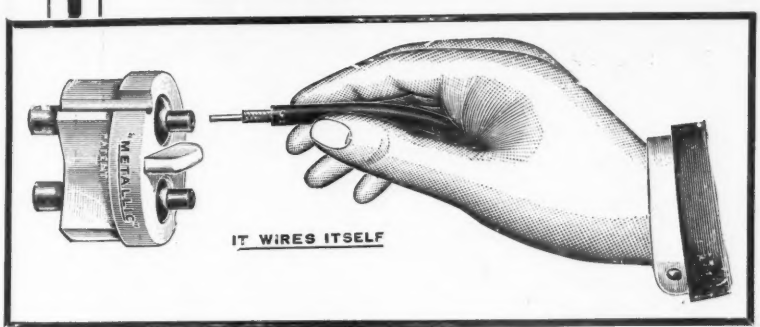

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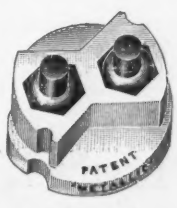
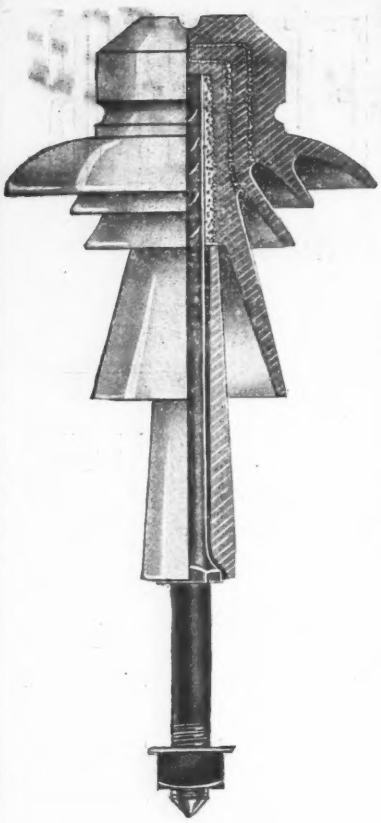


INTERIOR, PLUNGER END.
Note form of china.



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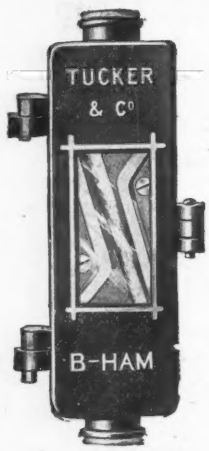

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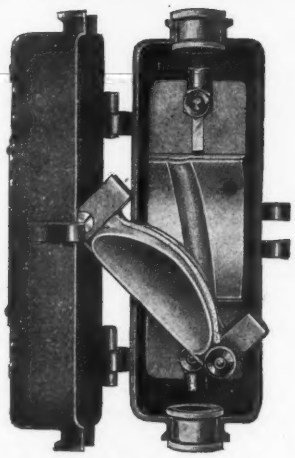

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Mr. C. S. Northcote, General Manager of Exhibition.

Mr. V. A. H. McCowen, City Electrical Engineer, Salford.—Consulting Electrical Engineer to Exhibition.

G

THE EXHIBITION.

ITS ORIGIN AND LOCATION.

To-morrow, at 10 a.m., the doors of the Manchester Electrical Exhibition will be thrown open to the public. The official opening, as announced elsewhere, will take place on Monday. There is no need to waste words in discussing whether Cottonopolis was a suitable centre in which to hold such an event, for the enthusiasm that the electrical and allied trades have shown in connection with the matter for many months past amply justifies our own early expressed conviction that the vastness of electrical industrial opportunities, and its high position among provincial manufacturing centres, stamped the Manchester district as a very profitable field in which to demonstrate. As to whether the date is the best, perhaps that is a point more open to question. When the matter was first mooted in the meeting of the National Electrical Manufacturers' Association there was a deplorable spirit of indecision among those who took part in the discussions, hence it came about that the advice to get in and take advantage of the tide before the great trade boom of the district subsided, had to be disregarded. It was not, of course, foreseen that Manchester's industries would have fallen under a wave of depression by October, 1908—that is a thing that no-one could guard against, but according to one way of looking at the matter, the success of the Exhibition might have been far greater had it been held one year earlier, though, on the other hand, we know that there are men who believe that if Lancashire has a slack time in her general trades it may afford a more convenient opportunity for the introduction of already overdue electrical installations. However, it was not only the difference of opinion, or the spirit of indecision, among members of the National Association, or their lamentably poor numerical attendance at the meetings where the matter was considered, that hindered—indeed, we believe that the greatest handicap that has bothered the Committee and managers has been the lack of a suitable building in Manchester for such an Exhibition. Exhibitors may, however, reap advantage from the fact that the premises have been expressly built suitable for their convenience. The fixing up of guarantees always is a more or less difficult matter, and an Exhibition scheme which has to bear the cost of putting up special buildings, and has to negotiate with so large a number of co-operating authorities, can neither be planned in a day nor carried out in a few weeks. However, be these things as they may, the difficulties have been grappled with, and the Exhibition should open under very promising circumstances to-morrow.

MAKING IT KNOWN.

One of the most important things necessary in order to ensure success is to thoroughly awaken the interest of the engineers and industrial managers of the country to the fact that the show is open, and that a visit thereto is likely to be followed by greater efficiency in the operation of their own establishments. Whatever there may have been in London three years ago at Olympia, and whatever there may or may not be there again in 1910, it is certain that there never before has been, and for some years to come probably will not be, in the provinces, another such display of electrical applications as that at Fallowfields.

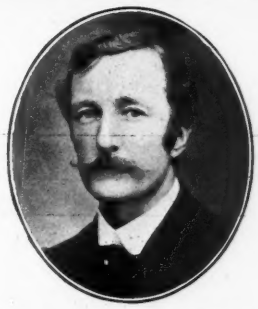
It would not surprise us if, when once the importance of the exhibits becomes well known, there are visitors from quite other parts of the country besides the Manchester or Lancashire district—the idea to be worked upon is making it known. To some extent this must be regarded as one of the duties of the management of the Exhibition, costly and elaborate as the necessary advertising must be if the best publicity is to be secured. But it is also a duty of the exhibitors who, by their correspondence, have for some time past been telling it broadcast that they are exhibiting at Manchester. Yet there is no doubt that much remains to be done. We do not know what steps the various corporations and supply authorities of the area more particularly concerned have been doing to bring the matter home to the public intelligence. It seems to us that there might, with profit, have been an elaborate circularising or canvassing of *all* power-users other than electrical, accompanied with a free pass into the Exhibition, and some attractive publicity literature might also have been circulated among a large number of the gas lighting consumers. We cannot believe that the importance of something of this kind has been overlooked by the authorities who are ambitious to secure benefit from the educational influences that are to be expected from such a demonstration as we are making. It is useless to run an Exhibition on such a scale as this unless we get the right people there.

EFFICIENT REPRESENTATION.

Another point that ought to be emphasised here—and we emphasise it because of our own experience at past Exhibitions—is that it is ten thousand pities if, after we have got the people there, we have not the right representatives available to talk with them about the adaptability of electricity to their own class of industry, and the advantages accruing therefrom. If it should happen that any local electricity suppliers have come short of their duty in the matter of interest-awakening, or if exhibitors are not prepared with adequate efficient representation, there is still a little time to set these things right. While the Exhibition authorities and the suppliers of electricity can do much to work up the desired interest, for the exhibitors themselves ought to concentrate their attention upon potential users by discreet circularisation. All of these interests and influences operating simultaneously should produce an electrical campaign which would be thorough and effective, bringing good business to all departments of the electrical industry, if there is that business there to get—as we believe there is.

TIMELY INFORMATION.

We have ourselves endeavoured in the following pages to provide the electrical trade with information, which, we believe, will be of interest and value to them in the above connection. We are enabled to publish photographs of most of the gentlemen who hold seats on the Executive Committee or are identified with the Exhibition in other ways; we are also indebted to Mr. S. L. Pearce, the city electrical engineer of Manchester, for an interesting article on the supply of power from his own magnificent undertaking, showing examples of some of the excellent business he is doing among large power-users. Our readers will find a thoughtful article from another contributor on the possibilities that lie before electrical application in the sphere of influence of the Exhibition. These articles should be closely studied. The plan of the Exhibition Hall, with its accompanying key to the respective stands, and also the article on the system of supply of electricity to the Exhibition buildings, should be of service to our readers. To these special features we add a first instalment of an examination of the whole subject of the mills of Lancashire and electric driving, in which matter, as any tyro knows, lies one of the great hopes of the electrical industry in that part of the country.



Mr. S. G. Castle Russell.—Honorary Consulting Electrical Engineer to Exhibition.

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Mr. H. Oppenheimer (International Electric Co.). — Representative of the National Electrical Manufacturers' Association.

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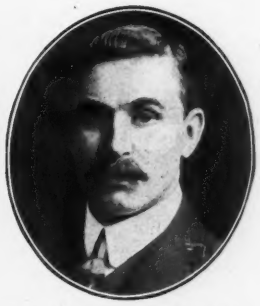
Mr. D. N. Dunlop (British Westinghouse Elec. & Mfg. Co., Ltd.).—Representing General Exhibitors.

Mr. T. J. Grainger (Sunbeam Lamp Co.). — Representing General Exhibitors.



Mr. B. Longbottom (Electromotors, Ltd.). —Representing General Exhibitors.

The Photographs appearing on the first and third pages of this Supplement were taken as follows:—

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Elliott & Fry: Sir William Preece, Mr. C. P. Sparks and Mr. S. G. Russell.

Stereoscopic Co., London: Mr. Oppenheimer.

Mr. A. A. Day, Borough Electrical Engineer, Bolton. — Representative of Corporations subscribing to Exhibition Funds.

Mr. T. Roles, City Electrical Engineer, Bradford. — Representative of Corporations subscribing to Exhibition Funds.

Mr. S. J. Watson, Borough Electrical Engineer, Bury.—Representative of Corporations subscribing to Exhibition Funds.

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Abernethy, Belfast: Mr. V. A. H. McCowen.

N. S. Kay, Manchester: Mr. I. Frankenburg.

Guttenberg, Manchester: Councillor Barrett.

Brown, Barnes and Bell, Manchester: Mr. A. A. Day.

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Adams Manufacturing Co., Ltd.	130A
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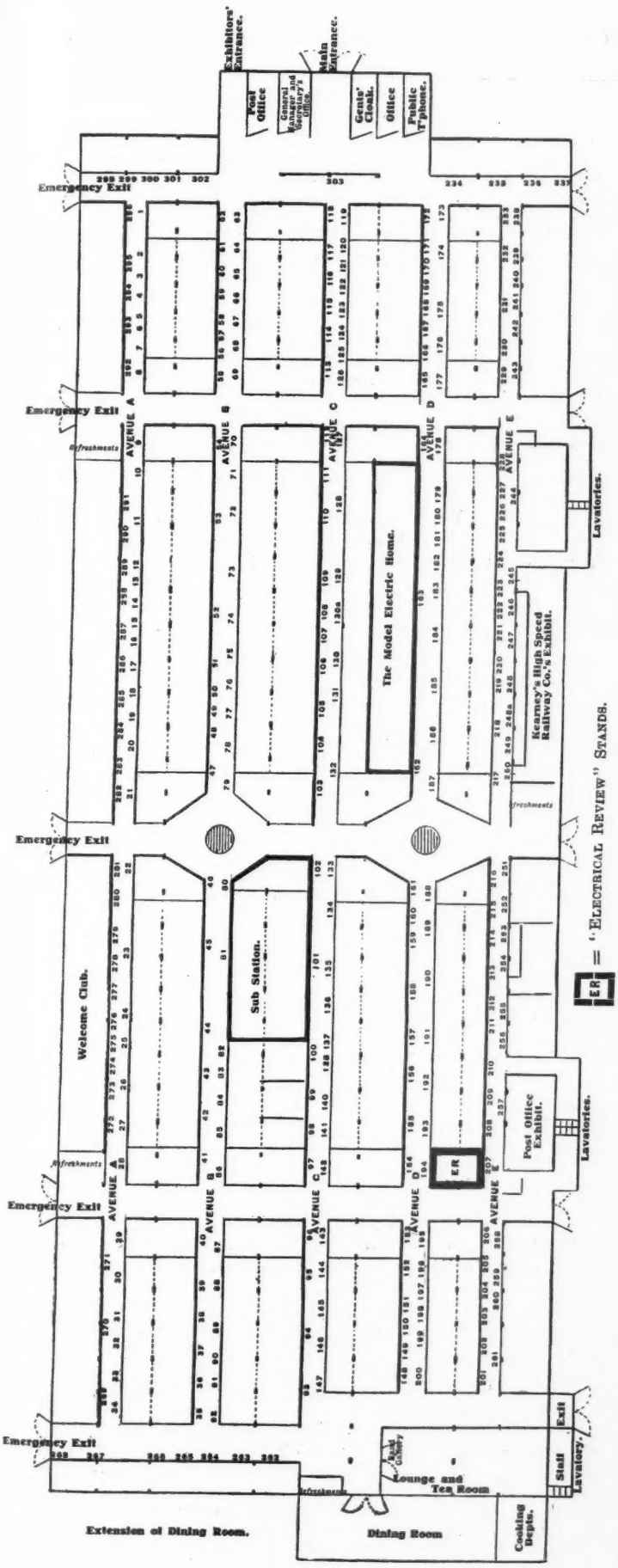


Plan of Hall, with Numbered Stands.

SOME EXHIBITION ARRANGEMENTS.

THE OPENING ARRANGEMENTS.

The Exhibition will open on Saturday, October 3rd, at 10 a.m., and will be open daily (Sundays excepted) until Saturday, October 31st, from 10 a.m. to 10 p.m. To-morrow there will be a reception of Press representatives by the Committee and Management in the Welcome Club at the Exhibition, followed by a Press luncheon in the Dining Hall. On Monday morning next, October 5th, the Lord Mayor of Manchester will officially open the Exhibition at noon, and will afterwards lunch with the Committee at 1.30 p.m. As the Dining Hall is not considered large enough to accommodate the guests and the whole of the exhibitors, the latter have been informed that the charge to them for either of the luncheons named will be 10s. 6d. each, inclusive of wine.

We do not propose in this issue to give any detailed forecast of exhibits, as we think that the list of exhibitors will convey a good deal, but as the result of inquiries that we have been making, we are able to state that there will be a varied and representative collection of electrically-driven machinery and tools, electrical and steam engine and boiler plant and apparatus, switchgear, economisers, stokers, batteries, electrically-driven pumps, as well as multifarious lamps—arc, incandescent and metal-filament—switches, and general electric lighting, power, telegraph and telephone material.

During the month a number of gatherings are to take place in the Exhibition buildings, which will bring together those who may be expected to learn many useful things at a show of this kind, not the least useful being where to place their orders in future.

It is intended to issue a daily programme of band music, and on this any notices of probable visits or meetings will appear.

The Northern Section of the Electrical Contractors' Association will meet on Saturday October 17th, at 11 a.m., and a "propagandist meeting" is announced to follow. This meeting is to be open to all contractors, and the objects of the Association will be explained.

MANCHESTER CORPORATION.

The Stand reserved for Mr. Pearce's own department will have no special exhibits, it being occupied with an office from which suitable literature can be distributed; this will include all descriptions of canvassing publications to satiate the thirst of an inquiring public whose interest has been worked up to the proper point; naturally it is also hoped that many inquiries from probable customers will be handled here. The office will contain plans and photographs illustrative of the generating stations, and, indeed, of the Manchester electricity system in general.

LANCASHIRE ELECTRIC POWER CO.

This company's exhibit consists entirely of maps, diagrams and photographs. There will be a large size scale map showing the area over which the company have powers to supply, and the position of their mains. The photographs in all cases will be those of installations which are at present supplied from the system, but generally speaking this Stand will consist simply of an office. May there be a host of power-consumers inquiring here, to help the company to secure its long-delayed commercial success.

OTHER MATTERS.

On the Stand of Messrs. Reyrolle & Co., Ltd., among other things, there will be an exhibit of the Merz-Price patent system for the protection of large transmission schemes, shown under working conditions. Heavy currents will be passed through the connections made to represent a section of a power scheme, including two sub-stations and a generating station, and tests will be made to prove the reliability of the system when acting under fault conditions. Messrs. Bullers, Ltd., will show insulators for H.T. work, and will carry out a series of experiments with currents up to 75,000 volts pressure, using a Westinghouse transformer with 5,000-volt steps. The experiments will show piercing tests, and will be carried out under working conditions as far as possible with a stream of water falling on the insulator, for instance, representing a tropical rainfall, such as their insulators are designed to work under.

THE ELECTRICAL SUPPLY TO THE MANCHESTER EXHIBITION.

FOR the purposes of general illumination and for supplying the various power and lighting requirements of the exhibitors, it has been necessary to erect a sub-station, which is located practically in the centre of the Exhibition building, and will form an exhibit of considerable interest. Two of the existing ·15 sq. in. E.H.T. 6,500-volt three-phase feeders from Stuart Street are diverted and brought into the sub-station; and the following converting and transforming plant is provided for the D.C. requirements:—

One 700-KW. rotary converter, complete with starting induction motor and A.C. booster on the one shaft, by the British Westinghouse Co., Ltd.

One 800-KW. three-phase static transformer for the above.

One 600-KW. three-bearing type motor-converter, by Bruce Peebles & Co., Ltd. (A reference to this appears on p. 553.)

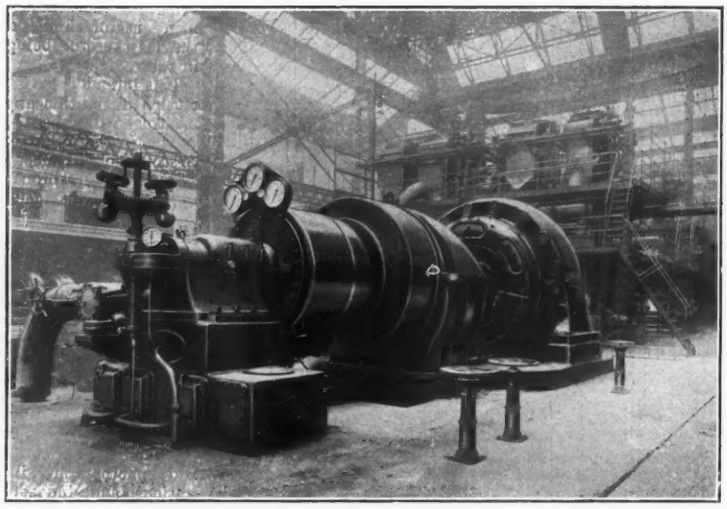
One 500-KW. two-bearing type induction motor-generator, by the General Electric Co., Ltd.

Each of the above sets is arranged for three-wire balancing. They, with the switchgear, are respectively representative of the most modern practices obtaining to-day.

For the A.C. requirements the following static transforming plant is provided by the British Westinghouse Co.:—

Three 250-K.V.A. units, ratio 6,500/400. These are mesh connected on the primary side, and in order to provide a neutral, are supplied on the secondary side with three interconnected star balancing coils for the lighting supplies at 230 volts.

The E.H.T. and L.T. switchgear for controlling the sub-station equipment, as well as the whole of the various D.C. and A.C. distributing feeder circuits, arc lighting and domestic circuits for the Exhibition, have been supplied by Messrs. Ferranti, Ltd., of Hollinwood.



A VIEW OF STUART STREET GENERATING STATION.

The E.H.T. gear is completely enclosed in concrete cells; it comprises eight complete panels, and possesses many points of interest.

The L.T. panels call for no special comment.

It should be mentioned that the whole of the sub-station equipment has been built to comply with the Manchester Corporation requirements, and to its standard specifications.

Single-core cables for wiring up the machines to the switchboards are run on insulators provided beneath the flooring of the sub-station.

On account of the somewhat limited space available, and the particular construction of the Exhibition building, the general lay-out of the sub-station has been a matter of some little difficulty. The result, however, is such that a minimum space is occupied without unduly cramping the plant, and on three sides the sub-station is open to full inspection by the general public.

From the sub-station, 12 three-wire D.C. feeder circuits, each of ·25 sq. in., ·125 sq. in., ·25 sq. in. section, are run underground before rising up to the distributing fuseboards. These latter are of the ironclad, and totally enclosed type, and are mounted high up on the uprights of the building supporting the roof principals. Two D.P. boards are provided at each feeding point, the middle wire being split between the two. In all twenty-four D.P. boards have therefore been required.

Twelve ways are provided on each board, and each is capable of carrying 30—40 amperes.

In a somewhat similar manner the A.C. feeder circuits of ·075 sq. in. section, comprising four single conductors, are run to four points in the building, where the three-phase distribution fuseboards are fixed. The latter are of a similar type to the D.C. boards, and all have been provided by Messrs. Reyrolle & Co., of Hebburn-on-Tyne.

In addition, there are some eight circuits ranging in capacity from 25 to 150 amperes in connection with the glow lamp illumination of the front, and the domestic lighting of the main building.

The service mains to the stands are all run overhead from the several distribution boards as required, the mains being brought down the building columns to the exhibitors' switchboard, on which the main switches and fuses and meters are mounted by the management.

The whole of the switchgear for controlling the supplies to the stands is of the fool-proof type supplied by Messrs. Berry, Skinner and Co.

In the case of some dozen exhibitors who require a large supply, underground mains are laid direct to their respective stands, and they are controlled directly from the sub-station distribution panels.

It is anticipated from the applications received that the demand on the sub-station for power and lighting purposes, A.C. and D.C., will amount to some 1,300 KW. The whole of the wiring of the building as thus far described has been almost entirely carried out by the electricity department of the Corporation.

Some 16 circuits control the general illumination of the building. For the interior, 44 flame arcs and 10 enclosed arcs have been supplied by Messrs. Oliver Arc Lamp Co., the General Electric Co., and the Gilbert Arc Lamp Co.

For the front exterior of the building, as well as for the approach road lighting, 24 flame arcs have been supplied by the Gilbert Arc Lamp Co., and the British Westinghouse Co.

The wiring contract in connection with the arc circuits, as well as the general domestic lighting of the dining room, tea room, Welcome Club, &c., have been carried out by Mr. J. Lomax Kendall, of Manchester.

In addition to the arc lighting of the front of the building, several hundreds of coloured lamps will be used for the decoration and illumination of the front, and of the trees which form an effective foreground to the site. This portion of the work was entrusted to Messrs. Pearson & Co., of Manchester.

The interior arc lighting of the building is arranged on 16 circuits, eight of which may be termed the "emergency" circuits. An alternative supply to these latter has been provided for from Messrs. Crossley's gas engine exhibit, in the event of any failure at the sub-station.

In conclusion, it should be added that the whole of the

work incidental to the lighting and power supplies and general illumination of the building has been planned by, and carried out under the supervision of, Mr. S. L. Pearce, the Manchester city electrical engineer, with whom has been associated as joint consulting engineer to the Exhibition management Mr. V. A. H. McCowen, borough electrical engineer of Salford. Mr. A. Wilkinson, of the Manchester Electricity Department, has been in charge of the work on the site.

THE POST OFFICE EXHIBIT.

The General Post Office (Engineer-in-Chief's Office) will have a representative exhibit of departmental instruments and apparatus of interest to telegraph and telephone engineers.

The historical apparatus forming the chief part of this exhibit includes the following:—Early form of lead-covered cable laid at Chalk Farm in 1840. Specimen of first submarine cable wire laid between Dover and Calais, 1850—picked up 1875. Sheerness Fort cable, recovered 1900. Samples of 80-wire cable laid between Bristol and Churchill; of 162-wire cable laid between Bath and Bristol; of 24-wire cable laid between Churchill and Weston; of 39-wire cable laid between Exeter and Tavistock. Piece of telegraph pole damaged by woodpeckers. An example of the preservative power of paint. Specimen punching sticks for Wheatstone perforator. Commutator tappers worn by fingering during 10 years' use. Dering's single-needle instrument, 1852. Gloesener's single-needle instrument. Bright's bell or double-plate sounder. Breguet's A.B.C. receiver. Wheatstone's A.B.C. type printer. Henley & Forster's magnetic Morse transmitter. Gower-Bell telephone, early form. Bell telephone, early form, 1879. Bell receiver A. G.B. telephone with bell. G.B. telephone with relay and neckpiece. Harmonic telegraph receiver. Tangent galvanometer, old form. Hughes typewriting instrument (pneumatic). Sounder and galvanometer combined, old form. Sounder and galvanometer combined, old form. Direct sounder with galvanometer. American sounder. Sounder, present type. Pony sounder. Varley's testing set. Double plate lightning protector, early form. Tube form of lightning protector. Varley's carbon lightning protector. Circular plate lightning protector. Mica disks for circular plate lightning protectors. Protector, present type. Telephone clock from fire caused by lightning at Truro P.O., 1903. Test tablet fused by lightning. Wheatstone receiver recovered after fire in Manchester P.O. Lodge magnifying telephone instrument, designed in 1898, for magnifying the electric impulse received on the parallel-wire system of wireless telegraphy, and for giving an audible calling signal on electric bell or other indicator. Varley's relay. Crossley telephone set, with early form Bell receiver. Adbank magneto Bell generator. Single-needle instrument, early form. Varley testing set. Varley's vacuum lightning protector, early form. Quadruple air-space cable, 76 wires, 150 lb. copper. Serrated plate lightning protector. Point lightning protectors. Orfordness submarine cable as re-made for Irish Channel, 1853-66. Edison telephone receiver. Strangways telephone transmitter. Edison telephone: button transmitter. Cables. Eight mounted specimens. Multiplex tongue relay for quad working. Incrementer quad relay.

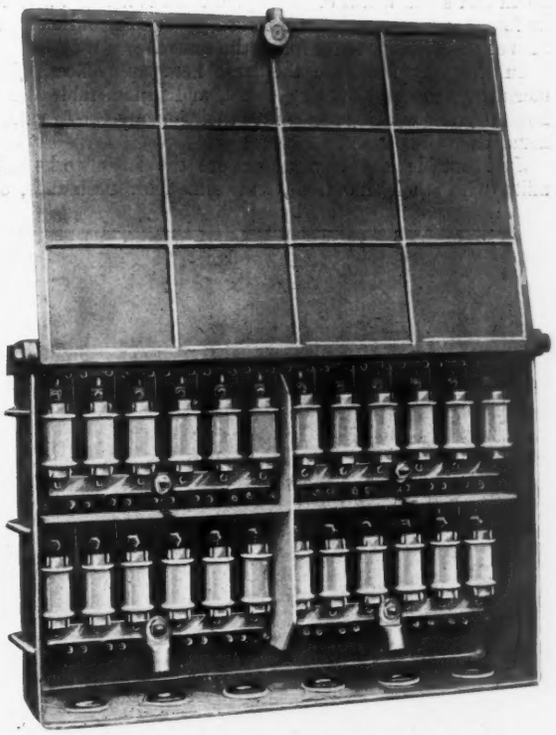
There will also be the following complete working circuits as used by the British Post Office:—Single-current sounder and printer circuit; quadruplex telegraphy; Wheatstone duplex with fast-speed repeater; central battery system representing an omnibus circuit; central battery duplex circuit.

THE SUB-STATION SWITCHGEAR.

Supplementing the brief notes given in the article appearing on the previous page on the sub-station equipment, we may say that the high-tension and low-tension switchboards have been constructed by Messrs. Ferranti, Ltd., and are typical of the latest up-to-date design of switchgear for controlling converting machinery, for taking a three-phase supply at 6,600 volts, and delivering direct current at 400 to 500 volts. The extra high-tension switchgear is of the compartmental design, *i.e.*, it consists of vertical columns of reinforced concrete cubicles in which the details of the high-tension gear are located and isolated from each other. The compartments are closed in front by ⅛ in. planished steel sheets, and at the back by iron floors. The switches are operated by handles projecting through the planished steel sheets in front of the switchboard, thus the whole arrangement is eminently safe against accidental contact and fire risks. This switchboard consists of two feeder panels, one motor-converter panel, one rotary-converter panel, one motor-generator panel, and one transformer panel. All the switches are of the automatic oil-break type, those on the feeder panels being fitted with no-volt release attachments, while the converter and transformer switches operate in conjunction with Ferranti's special time-limit relays. The latter switches are also provided with additional contacts, so that the high-tension circuit of the converter is initially closed through a water resistance, for the purpose of avoiding sudden electrostatic potential strains being thrown upon the winding of the machinery at the instant of closing circuit. Provision is made for entirely cutting off any panel from the bus-bars, and thus rendering any particular panel dead at will.

DISTRIBUTION BOXES AT THE EXHIBITION.

The distribution boxes which are to be seen in various parts of the Exhibition have been supplied by Messrs. A. Reyrolle & Co. There are about thirty in all, and the majority of them contain 12 double-pole 30-ampere ways. The boxes are of the cast-iron pattern, with which the name of this firm is now associated. Each set o



Reyrolle Distribution Box.

contacts and fuses is mounted on a separate slate base. The main feeders couple direct to the bus-bars from the underside, and the branch feeders from both poles lead out at the top. The fittings are mounted on two different planes, in order to allow the cable connections for the bottom row to clear the top row.

THE BROWN-BOVERI SYSTEM OF RING-SPINNING.

Messrs. Brown, Boveri & Co., as is well known, have devoted much attention to the application of the electric drive to textile machinery, and the special consideration which has been given to the matter of ring spinning, has resulted in the introduction of a system in which the speed of the frame is varied, so that the tension of the yarn as it leaves the nip of the rollers is maintained constant.

Three main objects are attained by varying the speed; these are (*a*) by keeping the tension on the thread at this point always constant, the spinning is better and more uniform; (*b*) by maintaining a steady tension below that of the maximum attained when running at constant speed, fewer ends are broken; (*c*) by increasing the speed when spinning on the full diameter of the cop (which is necessary to keep this tension constant), the average speed is considerably increased, and an increased output from the frame of some 15 per cent. is obtained.

A specially designed single-phase repulsion motor is employed, the speed of which is automatically controlled through a mechanism driven from the "heart" shaft or by an automatic slow speed motor which slowly pushes the brushes on the commutator as the bobbin fills up—according to the shape of cop intended.

The motors can be run on a three-phase supply; speed variation is effected simply by moving the brushes on the commutator, no resistances or other external devices being employed.

The system of working is also applicable to all types of spinning frames, the automatic gear being designed so as to vary the speed according to the requirements of the particular frame, the yarn, counts, and shape of cop.

Messrs. Brown, Boveri had set to work about 1,000 of these motors up to August last, 800 of which are driving ring-spinning and ring-doubling frames. Details of the system are fully set out in a pamphlet recently issued by the firm, and, in conjunction with their exhibit at Manchester, ought to attract considerable attention.

POWER IN THE MANCHESTER DISTRICT.

By S. L. PEARCE, A.M.I.C.E., M.I.E.E., M.I.Mech.E., City Electrical Engineer, Manchester.

With the possible exception of the district situated on the north and south banks of the Tyne, there is hardly likely to be found a better area for electrical power distribution than that of which Manchester forms the centre.

In the city itself are the large newspaper offices, with morning, noon and evening issues, and innumerable warehouses and workrooms, with their many and varied demands.

Just outside the city proper are the large works and mills, with their hundreds, and sometimes thousands, of horse-power; and continuing on to the outskirts of the area, for one industrial purpose or another, are demands for power which electricity can readily supply.

The area of the district in which the Corporation supply mains are actually laid is approximately 25 square miles, whilst the area of the district over which powers to supply are held is 44 square miles. In the latter area are included the districts of Heaton Norris, Levenshulme, Gorton, Denton, Audenshaw, Droylsden and Failsworth, which are outside the boundaries of the city.

The principal industries may be summarised under the following headings:—

(*a*) Textile trade, including spinning, weaving, bleaching, dyeing, finishing, and skirt, blouse, mantle and cap manufacturing.

(*b*) General and electrical engineering and motor-car works.

(*c*) Rubber works.

(*d*) Woodworking and box-making.

(*e*) Chemical works.

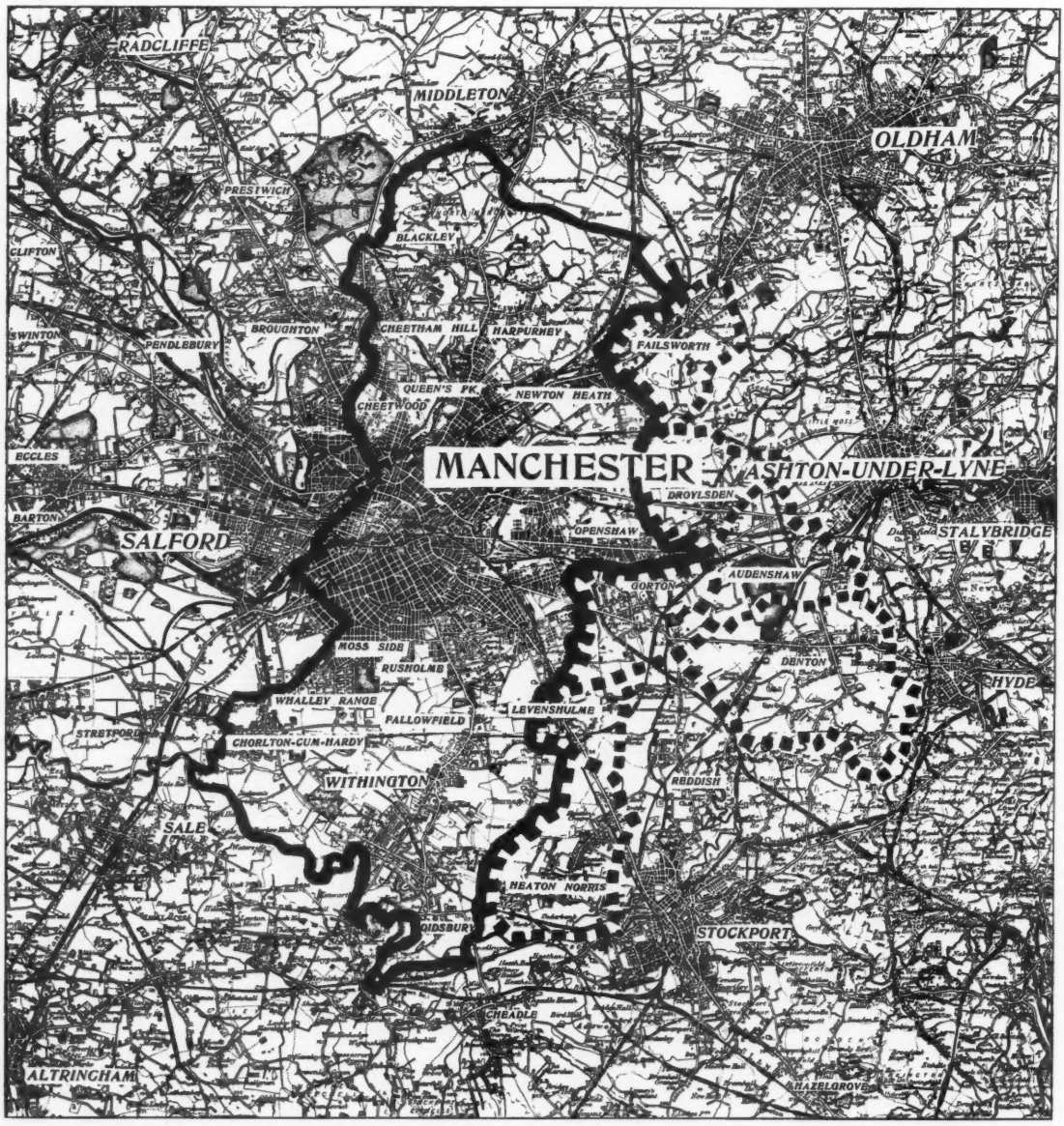


Fig. 1.—Map of Manchester and Surrounding Districts.

The writer has endeavoured to form an estimate of the total power requirements in the Manchester area, and as a result of his investigations, he estimates that the total power installed in the district for industrial purposes exceeds 750,000, and probably will not fall far short of 1,000,000 H.P.

Fig. 1 is a map of the Manchester area in relation to the surrounding districts, distinguishing between those areas which are within and without the city.

Fig. 3 is a plan of the area of supply showing generating

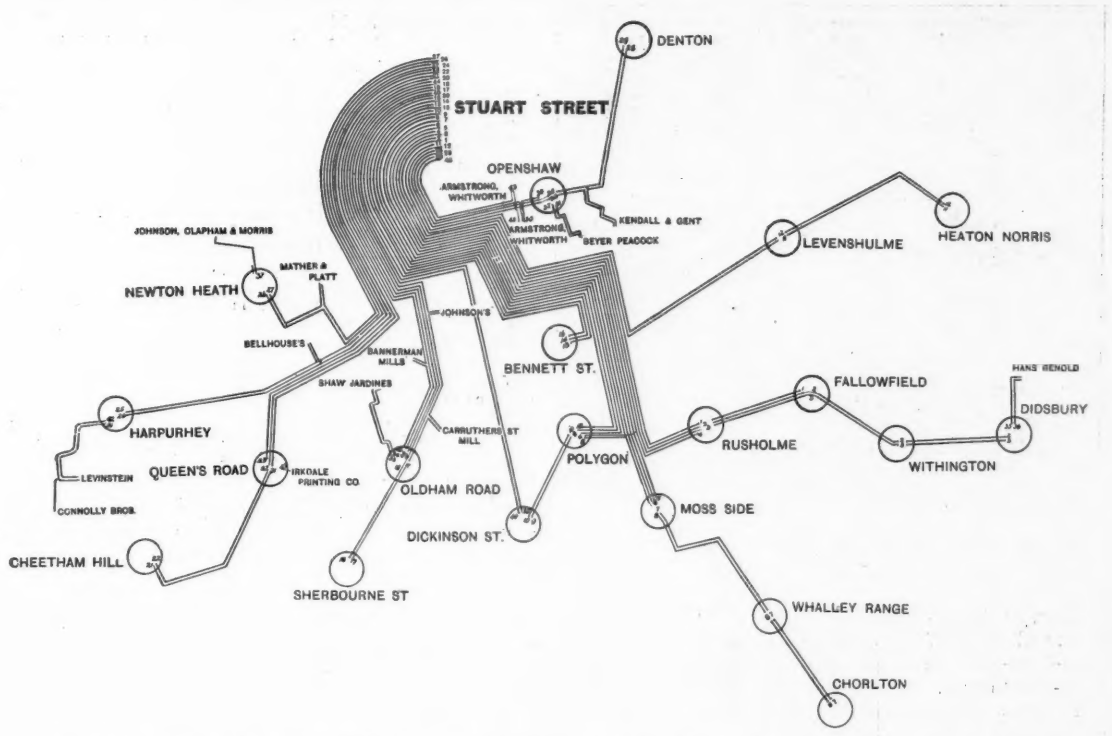


Fig. 2.—Plan of E.H.T. Mains. Explanatory References to Figure Numbers Appear in List Given Below.

Fig. 3.—Plan of Manchester Area of Supply showing Generating and Sub-stations, and Routes of Extra-High-Pressure Three-Phase Mains.

FIGURE REFERENCES FOR PLAN OF E.H.T. MAINS (FIG. 2).

No.	From Stuart Street—
1.	To Rusholme and Fallowfield.
2.	,, Withington and Didsbury.
3.	,, ,, ,,
4.	,, Rusholme and Polygon.
5.	,, Moss Side.
6.	,, ,,
7.	,, Whalley Range and Chorlton.
8.	,, ,, ,, ,,
9.	Through Polygon to Dickinson Street.
10.	,, ,, ,, ,,
11.	To Levenshulme and Heaton Norris.
12.	,, ,, ,, ,,
13.	,, Bennett Street.
14.	,, ,, ,,
15.	,, Polygon.
16.	,, Bennett Street.
17.	Through Johnson & Nephew's Carruthers Street Mill to Oldham Road and Sherbourne Street.
18.	To Sherbourne Street.
19.	,, Oldham Road.
20.	Through Bannerman Mills to Oldham Road.
21.	To Queen's Road and Cheetham Hill.
22.	,, ,, ,, ,, ,,
23.	,, ,, ,,
24.	,, Harpurhey, with tees to Bellhouses.
25.	,, ,, ,, ,,
26.	,, Newton Heath.
27.	Through Mather & Platt's to Newton Heath.
28.	To Openshaw and Denton, with tees to Kenda and Gent.
29.	,, Openshaw and Denton, with tees to Kenda and Gent.
30.	Through Armstrong, Whitworth's to Openshaw.
31.	From Openshaw to Beyer, Peacock & Co.'s.
32.	,, ,, ,, ,, ,,
33.	,, Oldham Road to Shaw, Jardine's.
34.	,, ,, ,, ,, ,,
35.	,, Didsbury to Hans Renold.
36.	,, ,, ,, ,,
37.	,, Newton Heath to Johnson, Clapham & Morris's.
39.	,, Stuart Street to Dickinson Street direct.
40.	,, ,, ,, ,, ,, ,,
41.	,, Harpurhey to Levinstein.
42.	,, ,, ,, and tee to Connolly's.
43.	,, Stuart Street to Armstrong, Whitworth's new sub-station, and then on to old sub-station.
44.	,, Stuart Street to Oldham Road.
45.	,, Queen's Road to Irkdale Printing Co.

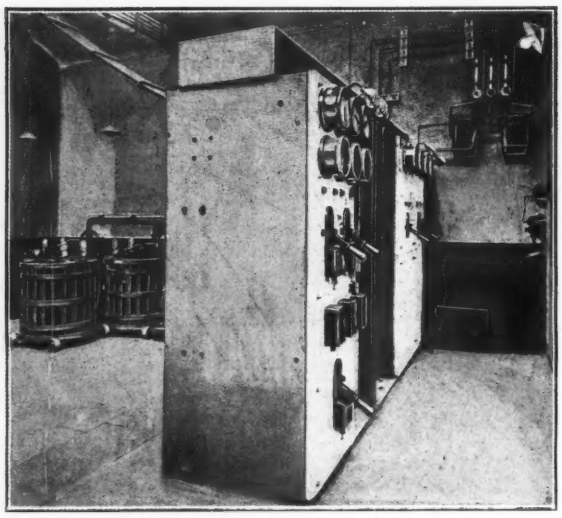


Fig. 4.—Sub-station at the Works of R. Johnson and Nephew.

stations, sub-stations, and routes of extra-high-pressure three-phase mains.

Fig. 2 is a plan of the E.H.T. mains laid up to the present time.

The Stuart Street station was primarily built and equipped to furnish some 20 motor-generator sub-stations with three-phase current, which is converted into continuous current and distributed to the tramway feeders, and to the lighting and power networks.

During the last two years, as a result of a forward policy on the part of the Electricity Committee, there has been a very considerable accession to the power load on the stations, notably by the addition of large consumers who have been connected up directly to the three-phase mains. Sub-stations have been installed on the consumers' premises, and the works have been supplied with direct or alternating current as required. It is anticipated that by March 31st next the three-phase power supplies for industrial purposes will total 20,000,000 units.

For the year ended March 31st, 1906, the power sales reached 7,006,574 units, and the equivalent horse-power connected was 12,110.

At March 31st, 1908, the power sales had increased to 20,608,659 units for the year, and the horse-power connected to 25,864. Since the latter date, further business has been acquired, and there is every indication that manufacturers prefer, where possible, to take their power requirements from public supply mains, rather than install independent plants.

The principal applications of electrical power attached to the Manchester supply mains are as follows:—

Spinning.
Weaving.
Dyeing.
Finishing.
Engineering.
Foundry and smithy work.
Woodworking (Cabinet making, Sawing, Turning, Box-making, &c.).
Sewing Machines (blouses, skirts, &c.).
Plaiting and lapping.
Chemical manufacture.
Wire-drawing.
Cable-making.
Rope-making.
Corn milling.
Painting.
Rubber manufacturing.
Laundry work (Washing, Ironing, Glazing, &c.).
Baking.
Pumping.
Ventilating.
Lifts, Hoists and Travelling Cranes.
Air Compressing.
Refrigerating.
Vacuum Cleaning.
Brewery Machinery.
Bottle Washing.
Grinding (Cutlery, &c.).
Mortar Mills.
Stone-crushing.
Bootmaking and Repairing.
Oil and Paint Manufacturing.
Dairy Work.
Brush-making.
Engraving.
Dentistry.
Guillotines.
Electric Pianos.
Organ-blowing.
Potato-washing.
Heating.
Cooking.
Medical Apparatus.

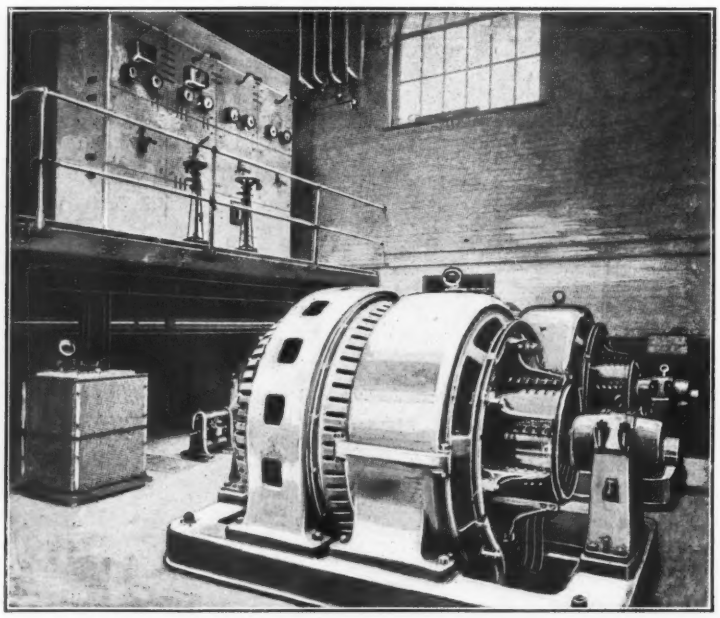


Fig. 5.—Sub-station at the Works of Armstrong, Whitworth & Co.

Figs. 4, 5 and 6 are typical of a three-phase static transformer, a converter, and a motor-generator sub-station respectively on consumers' premises.

The Corporation contracts to provide the H.T. and L.T. switchgear, and the transforming or converting plant, payment for which is included in the rates quoted for supply.

Needless to say, when the conditions will allow, special prices are quoted for large power supplies, and an agreement between the consumer and the department is entered into for periods of 5, 7, or 10 years.

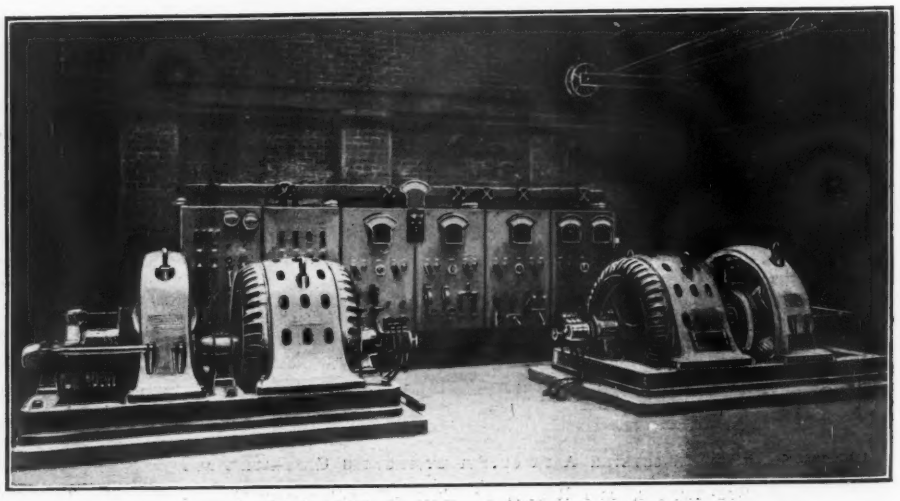


Fig. 6.—Interior View of Sub-station at the Works of Mather & Platt, Ltd.

For ordinary power requirements, the rates vary on a sliding scale according to load factor from 1¼d. to ·7d.

The motor hiring system has also assisted in the development of a power load for the district. At March 31st last there were 966 motors out on hire, totalling 4,373 H.P., and at the present date these figures have been respectively increased to 1,009 and 4,512.

As some indication of the trend of events, it may be mentioned that the following well-known and representative firms have found it advantageous to take their power requirements from the Corporation mains, in the majority of cases to the exclusion of their own steam or electrical plant, and in other cases as extensions to existing plants :—

Messrs. Armstrong, Whitworth	Engineers.
Messrs. Beyer, Peacock ...	Locomotive Works.
Messrs. Kendal & Gent ...	Machinists.
Messrs. Hans Renold	
The Fine Spinners' Association,	Textile Mills.
The Bannerman Mills Co. ...	
Messrs. Andrew & Bramhall ...	
Messrs. Mather & Platt ...	Electrical Engineers, &c.
Messrs. Levinstein	Chemical Works.
Messrs. Johnson & Nephew ...	Wire Rolling Mills.
Messrs. Bellhouse	Timber Yard.

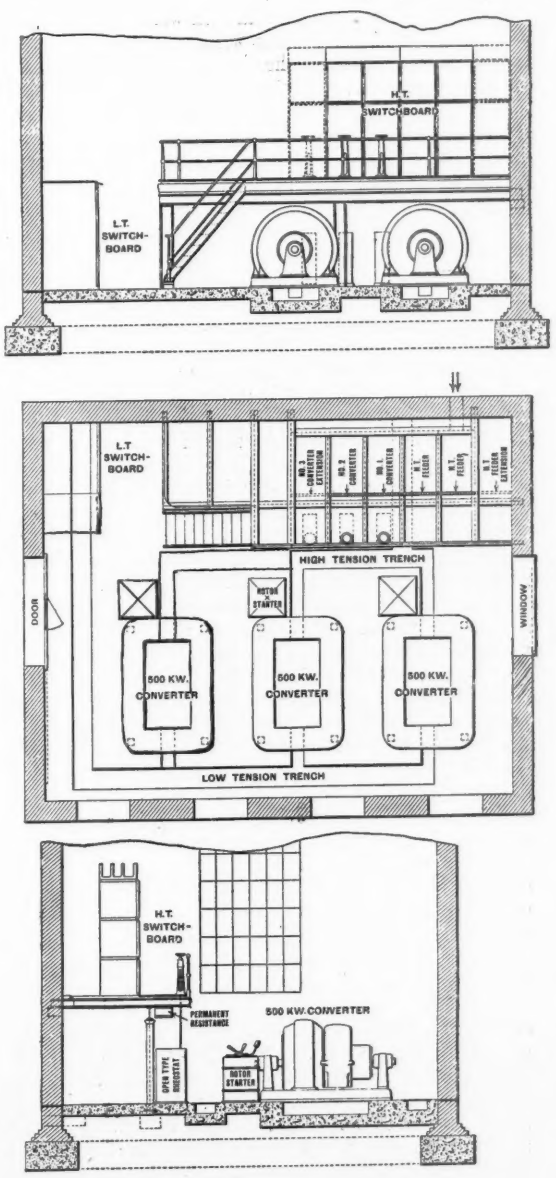


Fig. 7.—The Armstrong, Whitworth Sub-Station.

The idea of holding an Electrical Exhibition in Manchester was first suggested by the writer in his Chairman's Address before the Local Section of the Institution of Electrical Engineers in 1905, as he was convinced that if only the advantages and the adaptability of the electrical drive could be brought before the notice of the many manufacturing interests in the district, there was certain to be a great development in the use of electricity, which would not only benefit the supply undertakings in the surrounding neighbourhood, but the electrical industry generally.

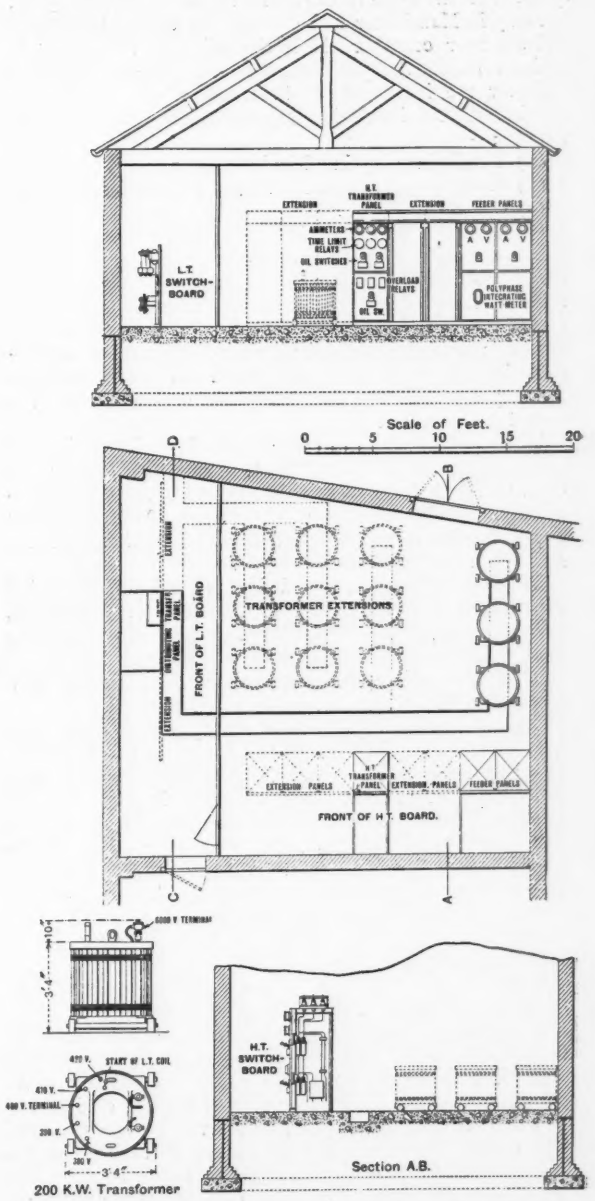


Fig. 8.—Sub-Station at R. Johnson & Nephew's Works.

We have a subject in which an interest and enthusiasm is, or ought to be, awakened with little effort; and a field which ought to yield excellent results.

At this date, when we are actually in the midst of the great pressure of work that devolves upon us all in connection with the initial stages of so large an undertaking as the Manchester Electrical Exhibition of 1908 has become, it only remains to urge that all shall work together with zeal and energy to ensure everything being completely successful to the electricity supplier, the electrical manufacturer, the seller of material, and the electrical contractor—indeed, to every department of the electrical industry, especially in Manchester and district.

POSSIBILITIES FOR THE DEVELOPMENT OF ELECTRICAL METHODS IN AND AROUND LANCASHIRE.

By A MANCHESTER ENGINEER.

The near approach of the date fixed for the opening of the Electrical Exhibition in Manchester raises the important question of the scope that remains for electrical enterprise, not only in Manchester and district, but also in Lancashire and the near counties. It is the object of this article to indicate briefly the possibilities for the sale of electrical plant for use in the staple industries of the Lancashire district. These industries may be briefly summarised as follows :—

(*a*) Textile industry in all its branches.
(*b*) Heavy engineering and machine tool manufacturing.
(*c*) Colliery working.
(*d*) Chemical industry.

The demand for power represented in the aggregate by the above-mentioned industries is enormous. The spinning mills of Lancashire are alone estimated to be using fully 500,000 H.P., and the allied trades such as weaving, bleaching, printing, dyeing and finishing cannot fall far—if at all—short in their use of mechanical power. Hence in the textile industry alone we find that the power used totals not less than 1,000,000 H.P.

There is here, then, an enormous field for electrical enterprise, seeing that it has recently been shown that only 6 per cent. of the Lancashire spindles are at present driven electrically. Put into figures, this represents 30,000 H.P., with a capital value in generators, motors, cables, &c., of about £250,000.

Weaving sheds have probably not adopted electrical methods to even 6 per cent. of the total power required, although owing, generally speaking, to the smaller power of a weaving-shed engine this class of work offers better opportunities to a supply from the public mains than does a spinning mill, with its demand for 1,500 H.P.

Bleachworks and works of a similar nature have been converted to electrical driving to a far greater extent than either spinning mills or weaving sheds, and there is very good reason why this should be the case. In the past nearly every machine in a bleach or print works had its own engine, usually a two-cylinder affair, each cylinder receiving high-pressure steam, the cylinders unlagged, and exhausting either into drying cylinders or to atmosphere. To supply these engines there were frequently hundreds of yards of steam piping, also unlagged, and a very large proportion of the steam entering the pipes only reached the engines in the form of water. To works of this description—Lancashire abounds in them, and it may almost be said that where there is a stream of good water there will a bleach or kindred works be found—electricity has come as a great boon, and the owners have not been slow to avail themselves of its advantages. The old method of isolated engines was not only extravagant in steam, but the varying speed reduced the output, whilst the cost of upkeep of the engines was very great. There are at the present time a large number of such engines still in use, but obviously their days are definitely numbered.

The conditions under which motors have to operate in such works are rather trying, as water is used very freely in many of the processes ; but it speaks volumes for the high standard of excellence of modern motors that they have not been found wanting. They often have to operate over wide ranges of speed ; a calico printing machine, for instance, will usually require a range of speed of 3 to 1, or 4 to 1, the primary reduction in speed of the motor being about 20 to 1. That these conditions have been successfully met by three-phase motors is an interesting fact ; in one installation a worm drive has been used for the main speed reduction for the printing machines, with series resistances for the variable range, and so successful is this installation that it would appear likely to be copied in many similar works. No one will contend that the arrangement is an economical one, but the advantages of three-phase supply for works of this description are in general so pronounced that it pays to run a few variable-speed machines in the manner described rather than convert the whole supply to direct current.

It will, therefore, be seen that in works of this description there is a wide and acknowledged field for the further use of electrical methods, the class of business being one in which it is now universally admitted that electrical driving is supreme. What are the prospects in the large mills ? It appears to us that something more than eloquence and a slight saving in cost is necessary before millowners will adopt electrical driving on a wholesale scale ; that such a time will come is inevitable, having regard to the great cost, comparatively speaking, of working the hundreds of mill engines now in use. The mills are built in many cases so close together that one wonders the owners do not combine for a central supply of their own. We believe that schemes of this sort have been mooted, but local authorities do not like their streets being used by private interests, and wayleaves have been too difficult to obtain.

We are of opinion that in order to induce millowners to look with more favour upon electrical methods, definite proof is required that a greater output and a better quality of yarn and cloth can be produced by the electrical drive than by their present system. If our information is correct, there will be shown at the forthcoming Exhibition a variable speed alternating-current motor, which has already been brought to the notice of some of the leading textile machinery makers in Lancashire, and for which very great advantages are claimed. This motor will be shown operating a spinning frame, and by means of an automatic speed variation it is stated that an increased output of about 10 per cent. can be obtained from any given frame, and this is coupled with a marked improvement in the quality of the yarn. Assuming that this twofold claim can be substantiated, this type of motor should give a great impetus to the more general adoption of electrical driving in the large mills of Lancashire.

As regards weaving sheds, there is good reason to hope that the pioneer work of the past few years is beginning to bear fruit, and we know of cases where firms who have made a tentative trial of electrical driving have become out-and-out converts, owing not only to the superior quality of the cloth obtained from the constant speed and even turning moment of the electric motor, but also to the reduced bill for the repair of their looms.

Passing on now to the prospects of electrical work in the engineering industry, we find that in this field electric motors are already pre-eminent. The majority of the leading shops in the district are already driven electrically, and mention may be made in particular of Messrs. Armstrong, Whitworth and Co., and Messrs. Beyer, Peacock & Co., who take their supply from the Manchester Corporation ; of Messrs. J. Musgrave & Co., who are consumers of the Bolton Corporation ; and of Messrs. Dobson & Barlow, whose new works just outside Bolton are supplied from the mains of the Lancashire Electric Power Co. These names are household words in Lancashire, and we have quoted them to show that the engineering industry is well to the fore in utilising the advantages of electricity, as indeed it should be, and that in general the supply is obtained from the public supply mains. There are still, it is true, many small, and a few large, shops still to be changed over, but this field is one of the easiest for the canvasser to deal with.

When we come to the consideration of electricity in the mining industry, we find a woeful want of enterprise in the Lancashire coalfields ; presumably because there has always been such a great demand for coal at their very doors, and because, therefore, the coal raised has easily been disposed of, the colliery-owners have failed to keep up-to-date in their

methods of either getting their coal or selling it. In most of the other coal-producing districts, electrical plants abound, but if one examines the lists issued by electrical firms of colliery work which they have carried out, Lancashire collieries are usually conspicuous by their absence. Similarly, if you ask an agent for particulars of the calorific value of the fuel he is trying to sell, he invariably has to acknowledge his ignorance, and suggests that a trial of a few wagons would give you the information you require. Such people quite fail to see that a thorough knowledge of the quality of the coal they have to sell, particularly where the quality is high, is essential if they are to sell their goods intelligently. There are now signs, chiefly owing to the insistence of electrical engineers in asking for calorific values, that an improvement is taking place, just as there are many indications that the lethargy of colliery-owners as to the advantages of the electric motor is gradually disappearing.

It follows, therefore, that the scope for the supply of electrical apparatus in this industry is enormous, and it is a field which is particularly favourable to cable-makers as well as to motor manufacturers, owing to the long and heavy lengths of cable which are so often required down pit shafts; for all underground work, such as pumping, hauling, and coal-cutting, there is no system which can compete with electricity, both for economy and convenience, while for the work at the pit-top, where frequently water and coal-dust reign universal, the enclosed electric motor has no equal.

As regards the chemical industry, the Lancashire district is one of the largest consumers in the world, if not actually the largest, of chemical products and dyes, and in the production of these materials electricity now plays a highly important part; in fact, it is due to the existence of cheap water-power that these industries have made such great headway in Norway and Sweden and other foreign countries. We are, however, amongst those that believe that the electric supply industry has not yet uttered the last word on the cheap production of electricity from steam in this country; and if energy can be supplied at from ·2d. to ·25d. per unit under some system of restricted hours, we do not hesitate to say that an immense impetus will be given to the chemical industry over here. The facts that the Newcastle Electric Supply Co. is already supplying a large amount of power for electrolytic processes, and that the Yorkshire Electric Power Co. is supplying current for the production of calcium carbide, not only offer ample evidence of the feasibility of what we suggest, but they also prove that when the facilities are given the demand will arise. The present is an opportune time for pressing home the capability of public generating stations for dealing with this class of work, as owing to the operation of the new Patents Act a large number of schemes are being mooted for manufacturing, in this country, chemicals and dyes which have hitherto been made abroad; and it is certain that no better locality exists for work of this description than the Lancashire district, with its enormous consumption of the class of goods in question.

In addition to the special branches of work to which we have made reference above, there are many miscellaneous classes, such as paper works, corn mills, and the like, which offer an excellent field for electrical enterprise, and in which electricity has already established a sound footing.

The object of the promoters of the Exhibition is to bring home to the owners of works of every description the advantages of electricity for their processes, and it remains for those who are taking part in the Exhibition as exhibitors to make the most of their opportunities during the coming month, and to put their facts and figures in an attractive form before the men who control the industries here referred to, men who are in many cases already half-convinced that electrical driving is a necessity for their works.

LANCASHIRE MILLS AND ELECTRICAL DRIVING.—I.

By F. J. A. MATTHEWS.

The term "Lancashire mills" comprises spinning mills, weaving sheds, bleach works and print works; manufacturers, generally, engaged in other industries owe a large debt to these Lancashire mills, because much of the advance which has been made in engineering work during the last half-century has been due to the special conditions obtaining in them. Probably in no other branch of industry, considered as a whole, will there be found such well-designed and carefully built engines and such smooth-running shafting as is the case in the cotton mills. Individual factories may be as well equipped as the most up-to-date cotton mill, but such is the exception rather than the rule.

At first it would seem most likely that the engineering works would have the most efficient and economical driving arrangements, as they are under the management of persons who have made a study of the economics of the transmission of power, but until the adoption of electrical transmission of power in recent years, this was not the case; indeed, on the contrary, as a general rule, the cotton mill was infinitely better equipped as regards its power installation than was the average engineering shop or shipyard.

With the advent of electrical driving, the condition of affairs was altered to a considerable extent, and whilst one large engineering works after another first experimented with electrical driving and then adopted it throughout, for many years no one interested in any Lancashire mill seemed disposed to adopt the new system. This was not because the Lancashire mill-owners had ceased to be interested in the economical running of their mills, but was rather due to the entirely different conditions that obtain in engineering works and cotton mills: it was, in fact, due to the same cause that had led the mill-owners to insist on the high-class engines, which are a feature of all cotton mills.

The differences between the working of a cotton mill (more especially spinning and weaving) and that of an engineering shop may be summarised as follows:—

1. In a cotton mill the hours of work are closely defined; if a stoppage occurs during these defined hours due to a defect in the driving arrangements, or to any other cause, the time is lost, and cannot be made up by overtime. In an engineering shop, on the contrary, the hours of work are not so defined, and lost time can be made up.

2. The demand for power in a cotton mill is practically constant during the whole period of working, while in engineering work the demand is of a fluctuating character.

3. It is more essential in a cotton mill that the turning moment should be perfectly regular, than is the case in any other branch of industry.

4. The production in a cotton mill bears a definite ratio to the power, and this is not the case in engineering works.

5. The requirements for power are more centralised, and it is not often necessary to carry shafting or steam pipes long distances to supply a small or irregular amount of power at a point far away from the boilers or main engines.

It was largely on account of the last difference in the working that electric transmission was not adopted in cotton mills at an earlier date, and not on account of any hostility on the part of the owners. This is clearly shown by the fact that electric transmission was adopted in the Lancashire mills first in bleach works and print works, where the conditions are different from those obtaining in the spinning mills and weaving sheds, inasmuch as in these works a large number of auxiliary engines is required, and these being not so centrally situated as is the engine of a spinning mill, great economy in transmission could be shown by the adoption of the electric drive.

The first four conditions mentioned above were the first cause of the great advance in the design and building of the mill engines, and, secondly, the cause why electric driving in cotton mills is not more universal. The fact that lost time could not be made up led owners to insist upon being supplied with engines which were so designed that the risk

of involuntary stoppage was reduced to a minimum. It was no less important to the owners that the engines should have a steady turning moment, so as to avoid risk of injury to the yarn or cloth during the process of manufacture, and that the economy in working should be as great as possible. The result was that in order to obtain trade, every manufacturer of mill engines was compelled to devote much thought to the careful design of his engines, and one detail after another which might, in any way, improve the design, was carefully considered and compared with previous practice, till gradually the high-class mill engine of the present day was evolved.

One great factor in this advance was that the engines had to give the high efficiency guaranteed in actual practice, and not simply on a test bed. If an engine were built for driving engineering works with a guaranteed efficiency, the only way to test whether this guarantee was met or not was by means of a special test, when probably the engine was more or less prepared for the test conditions; when the engine was doing its actual work no test could be made, as probably owing to the heterogeneous character of the work the load varied from minute to minute; but the case was quite different in the cotton mill, for the owner knew what quality of cloth he was weaving, or what number of counts he was spinning, and he also knew with a close approximation to accuracy what power he required for the production per week. His coal bill at the end of the week either agreed with the guarantee or it did not, and this was the nature of the test to which all the Lancashire mill engines were subjected, a test carried on without intermission from year's end to year's end. The result was that the mill-owner found he could procure at a reasonable price a high-class efficient engine, and as the same care was expended upon the shafting and transmission equipment generally, he saw no valid reason why he should make any change, nor could he see how any advantage would accrue through transforming his mechanical power derived from the main engine into electrical power, and then re-converting it into mechanical power by means of motors, especially when the power had to be transmitted only a short distance. On the other hand, the engineer or shipbuilder could see the advantages to be gained, as frequently he had not such an economical plant, while in addition he required power at long distances from the boilers, and in many instances long lengths of shafting were turning round all day long to supply only occasional needs for power.

Unfortunately, electrical engineers themselves hindered to a great extent the development of electrical power in Lancashire mills by their well-meant endeavours to secure its adoption, and this they did in a variety of ways.

First, they treated the cotton mill as they would any other factory, and for a considerable time no firm laid themselves out to study the special conditions that obtained; secondly, they made too many references to American practice: had they simply referred to those mills in America which derived their power from steam-driven dynamos no harm would have been done, but many representatives were fond of referring to the mills where the power was derived from water-power-driven dynamos situated at some considerable distance from the place where the power was required, and they descanted in glowing terms upon the ease with which hundreds of horse-power could be transmitted over long distances. As there were no large sources of water power in Lancashire such arguments did not appeal to the mill-owners, but caused them to think that electric power in cotton mills was only the practice in America because of the cheap water power, and not because it offered any intrinsic advantage over steam power.

Another error that was made was due to lack of standardisation. A mill-owner knew little about electricity, and felt that he would be to a very large extent in the hands of the contractors were he to make a change, and he naturally expected that those who had made a study of the subject should be in agreement, certainly upon the main principles, but instead he found that when he attempted to discuss the subject, too often his arguments were met with a jargon of semi-scientific terms that he could not understand; but what he did understand was that the scheme proposed by A was found to be entirely wrong by B. One representative advocated a pressure of 100 volts, a second a pressure of 200 volts, a third the adoption of an alternating-current system and so on, and as no valid reason, which could be grasped by the mill-owner, was advanced in support of any one scheme as against the others, the mill-owner naturally came to the conclusion that none knew what they were talking about.

Yet another cause which contributed to the delay in the electric equipment of the Lancashire mills was the cautiousness of the electrical firms. They had not the necessary confidence in their own manufactures, or if they had they certainly led their prospective customers to think otherwise. A firm would propose a scheme, including, say, three generating sets, two of which would be amply large enough to drive the mill, while the third was installed as a stand-by set for use in the event of a breakdown to either of the other two; a modification of the same scheme was to install two sets, each of such a size that in the event of a breakdown to either, the other could, by working up to its guaranteed overload capacity, run the mill until the first was repaired. The manufacturers forgot that the confidence of the seller is, to a large extent, reflected in the buyer, and had they gone to the mill-owner with such confidence in their own goods that they could pooh-pooh any suggestion of the necessity for a stand-by plant, there would have been a greater probability of business resulting. The mill-owner was aware that if any breakdown occurred, the time could not be made up, and the doubt implied by the manufacturers in suggesting the advisability of a stand-by plant was fatal. The steam-engine builder did not propose that a stand-by engine should be installed in the case of a steam transmission; he did not even propose that a spare cylinder or two, or a crankshaft should be kept in stock; he, too, was fully conversant with the seriousness of a shut-down, which would probably take longer to repair in the case of steam transmission than with electrical transmission, if only because the electrical plant would be standardised, while the mill engine would possibly have been designed specially for the mill. There is no doubt that in proposing the addition of stand-bys and spare parts, the electrical engineer was actuated by the best motives, and had no reason to fear that the plant he was offering would not be quite satisfactory, but at the same time it was a mistake to show any apparent lack of confidence.

Considering the satisfactory character of the existing driving arrangements, it was not surprising that the mill-owners showed no great desire to adopt electrical systems, which would not only have entailed the scrapping of a costly and efficient plant, but the installation of a system which was new to them, their managers, and above all to the engineers who would have charge of it, and electrical engineers, therefore, had to select those cases where old-fashioned engines were being abandoned and new engines installed. Here there was a good opportunity to show the greater economy of electrical driving as represented in the practical form best appreciated by the mill-owner, namely, the guaranteed future coal bill; but much of the increased efficiency shown would be due to the more modern type of engine, and would equally result from a re-modelled steam drive, so that no apparent tangible result followed.

During all this time the electrical industry was rapidly advancing to a higher degree of perfection; the generators and motors built by the leading firms not only were more efficient, but also, what was more important, were more reliable, and at the same time the knowledge available as to what class and type of machines were best suitable for different classes of work was increasing, while the results obtained from the electrification of the large engineering works, the greater degree of flexibility obtained from the electric drive, and in these works the increased economy, were being noted by men engaged in the cotton trade.

It has been seen that in bleach works and print works, which constitute an integral portion of the Lancashire mills, the conditions are different to those obtaining in spinning mills and weaving sheds; here the power is transmitted some distance to auxiliary engines, and the pioneer work done by Messrs. Mather & Platt, Ltd., of Manchester, in satisfactorily installing the electric drive in the works of Messrs. Schwabe, calico printers, and more recently in the works of Messrs. A. J. King & Co., bleachers and finishers, of Bollington, and the River Etherow Bleaching Co.'s Works at Hadfield, has since borne good fruit for the electrical trade generally. Not only the installations mentioned above

but most of the others to which reference will be made, have been so fully described in the Electrical Review, that it is only necessary to mention briefly some of the salient details.

In the case of the installation for Messrs. Schwabe, not only were there a large number of small motors for the preparing rooms, but the plant included nine large motors for the calico printing machines, where any speed is required between 5 yards and 60 yards per minute on the rollers, while it was also necessary to provide for a higher speed if required. Messrs. Mather & Platt successfully carried out the work, and so showed to the cotton trade that the electric drive could be of service to them.

Unfortunately, there was little opportunity to experiment in cotton mills. The hours of work are closely defined, and the owners are liable to fine if they start the engine before time; if, then, an owner wished to try the electric drive for a section of his machinery he had either to put down a separate engine to drive the dynamo, or else lose the time of starting the motors—say, 45 seconds—three times a day in the electrically-driven department. In the case of engineering works there was no such drawback, and the dynamo could, without any inconvenience, be belted to the main drive.

The next advance came when extensions were made to existing mills, an additional weaving shed or spinning room was built, and as this would probably be at some distance from the main engine, or at least involve costly alterations to the shafting equipment if mechanically driven, the electric drive was adopted. An instance of this is seen at the mills of the Preston Cotton Spinning and Manufacturing Co., Ltd., where a scheme for driving an additional weaving shed situated at the far end of the mill was prepared by the Vulcan Boiler Insurance Co., of Manchester, and successfully carried out by Messrs. Lightfoot Bros., of Manchester. The direct-current system was adopted, the generator being connected by ropes to one of the main engines. The motors, which were of the Parker enclosed type, were carried on steel girders close to the roof, the power being transmitted to the line shafts through ropes.

Many similar cases occur in different mills, and as satisfactory results were obtained, it was not surprising to find that cotton mill owners were open to consider the electric drive in the case of new mills, and it was seen that in such cases a considerable saving could be effected on the building alone, on account of the lighter construction necessary, while in the case of the spinning mill, each floor was more independent, and the large rope tower was abolished. One of the first weaving sheds to be electrically equipped was the new mill put up by the Heasandford Mill Co. at Burnley. This work was carried out by Messrs. Mather & Platt, who installed a three-phase alternator direct coupled to a Belliss engine, and the necessary number of three-phase induction motors to drive the entire mill. The motors in the weaving shed are mounted on brackets fixed to the end wall, and each line shaft is driven by a separate motor. The arrangement works very satisfactorily, and the economy is fully equal to that which would result with the best rope transmission, while the cost of equipment was no higher.

The Peebles-La Cour Motor-Converter.—The 600-kw. Peebles-La Cour motor-converter supplied by Messrs. Bruce Peebles & Co., Ltd., and briefly mentioned in our article on the system of supply to the Exhibition, is of their three-bearing type, and runs at a speed of 375 r.p.m. It receives the high-pressure three-phase supply at 6,500 volts, 50 cycles, and gives out continuous current at a pressure of from 415 to 425 volts for lighting, or, alternatively, of from 500 to 525 volts for traction. This, like all other of Messrs. Peebles's motor-converters, is suitable for working on a three-wire system as a balancer, the particular converter in question being designed to deal with a 20 per cent. out-of-balance current. It has a large overload capacity, a low temperature rise, and a high efficiency both on traction and lighting loads. The machine is started up direct from the a.c. side, and although the high-pressure current is supplied direct to the machine, it is particularly interesting to note that this high voltage is only on the stator, and is not taken to any moving part. The converter forms one of four such machines which Messrs. Bruce Peebles have just supplied to the Manchester Corporation.

ELECTRICITY IN THE HOME.

One of the most interesting exhibits that will occupy the attention of all classes of the general public who find their way to Fallowfields during the next month, will be the Model Home, in which electricity is allowed, so to speak, free play—that is, it is devoted with a prodigal hand to every conceivable application whereby it can add to the comfort and convenience of the family, its guests, and its domestic assistants. Undoubtedly one of the most attractive exhibits in the Machinery Hall at the Franco-British Exhibition is that of the London Electric Supply Companies, the chief object of which is to demonstrate these applications and their effects to those who desire more instructive entertainment than a flip-flap sensation producer can afford. The Manchester Model House will be at one distinct disadvantage when compared with that at Shepherd's Bush—visitors will not have been witnessing the effects of another form of illumination and heating in another house a few yards away. Perhaps the Manchester Exhibition authorities have thought that the necessary expense would not be warrantable, as the unwillingness of gas plant and fittings manufacturers to *lend* would have created the necessity for purchasing what there might have been some difficulty in disposing of afterwards. Who knows? However, let us hope that the impressions made upon the non-electrical user while in the Model Home will be such that he will see the folly of his ways when he returns to his own residence.

The Home is of charming design, and has been built, decorated and furnished by Messrs. Goodall, Lamb and Heighway, of King Street, Manchester, to whom we are indebted for some of the following particulars. It has been constructed on a low style, with one storey of rough-cast, painted white, with red tiled roof and overhanging door canopy surmounted with the heraldic device of former owners of Platt Hall. In a panel in one of the gables an inscription has been placed in French denoting that this is the little house with the Good Servants. The front is covered with trellis work for climbing plants to cling to. Entry is gained by the "sesame" door which opens automatically when the visitor steps upon the mat, and closes quietly when he steps off it. The entrance hall, snug and comfortable, with soft carpet, dark oak furniture and fireplace, and tapestry-covered wall now claims attention. An electric fire glows in the carved mantelpiece, and a central ceiling lantern and wall brackets shed plentiful light. Doors to the right and left of the hall lead to the other apartments; to the visitors' left is the spacious dining room, oak panelled in the Tudor manner with arched beams. The whole scene is one which would make the very gas-man break forth into poetic song in the words that have been supplied to us as follows:—

The overhanging carved fireplace, the deeply recessed mullioned window, with its quaintly-designed leaded lights, the thick soft carpet of restful hue, the rich mahogany furniture in the Sheraton manner, the silver lighting arrangements and beautiful table appointments exhibited by the world-famous Elkingtons, of St. Ann's Square, Manchester, the dinner service by Stevensons, of Manchester, form a *tout ensemble* worthy of the best English traditions of comfort, good taste and hospitality. Appropriately adjoining the dining room is the kitchen, to all housekeepers a most important apartment. Here the all-potent mysterious electricity is working wonders. In a bright tiled kitchen, unsullied by soot or smoke, it is roasting, stewing, boiling, chopping, mixing, boot-cleaning, knife-cleaning—in fact, allowing full swing to the genius of the cook.

We may interrupt this enthusiastic description to say that Messrs. Elkington have supplied for this exhibit some very fine specimens of electroliers, sconces, brackets and table fitments, and we may also be allowed incidentally to add that Elkington have supplied all the silver upon the dining sideboard and dining table, as well as that in the other compartments of the "Home."

Delicate schemes of decoration colour, under the old *régime* of smoky open fires and destructive gas lighting, were extravagant, and all too soon ruined. Now, in the words of the poet, "It is possible to indulge the fancy with painted ceilings and daintily-tinted walls, now that the corrosive fumes from the gas pipes no longer attack and destroy the hangings and draperies, and ere long the dreaded Spring-cleaning will be almost a thing of nought. These are thoughts which come to the mind when we enter the drawing-room of Messrs. Goodall's electric home. A spacious room, designed in the style of the later English Renaissance, the fashion

that was in vogue when Dutch William and his Consort, Mary, ruled these realms, we have here walls panelled in large divisions and painted in delicate tones of soft greens, with enriched white mouldings surrounding them, and a ceiling painted in the harmonious tints of an evening sky. A crystal chandelier and wall fittings shed graceful light on furniture of quaint design fashioned in walnut and other woods, upholstered in silk, on good pictures on the walls, and tastefully-selected ornaments in porcelain and in silver. Indeed, a restful apartment, with, as it were, the scent of rose leaves filling it in every part. A room to read in, to dream in, and where we 'may sit and let sweet music sink into our ears.'"

But enough of this; the Electrical Review is a trade journal, and we must to business. From the drawing-room we enter the principal bed chamber, spacious and airy, furnished in the simple, but nevertheless tasteful style, of the late eighteenth century. The furniture is in satinwood and mahogany, with oxidised silver mounts, the electric appliances for comfort and convenience are many, electric light to dress by, to read by, to write by, to warm by, even an electric warming pan is here.

Messrs. Drake & Gorham, Ltd., of London, are responsible for the installation lighting throughout the house, and for the fittings in this room, and in the drawing-room, hall, and kitchen. They have also supplied the electric radiators and heating apparatus in the reception rooms. The installation consists of a complete 25-volt plant comprising a direct-coupled oil engine and dynamo, 14 accumulators, and a switchboard with fool-proof regulator.

Undoubtedly the public should be interested in this exhibit during the whole month.

NON-EXHIBITORS AND PUBLICITY.

There are missing from the list of exhibitors many firms of high standing in the electrical industry, and these may find it necessary to adopt more ambitious measures than usual for keeping themselves in the mind of the trade, and the probable power and lighting consumer.

We live in years when we must all take advantage of the most enterprising methods available to obtain the maximum publicity effect, and when we say that let no one misunderstand. This publicity must be of a congenial kind suited to the English temperament and climate. We are not, as editors, enamoured of the methods of the managers of some publicity departments who seem to exist for a good proportion of their time for the purpose of producing works of irritation which any self-respecting editor regards as puffs, and drastically blue-pencils accordingly. In our humble opinion it is useful information rendered in a reasonable and comely form that achieves more, because it carries greater weight, than any palpable puff. We abhor the puff, and we pity the "puffer." On the other side of the Atlantic even our cousins are becoming wearied by *quid pro quo* publicity, and greater sense is going to prevail, both there and here before long, if we are not mistaken.

But there is foolishness alone written upon the brow of the man who in these days of commercial activity has a good thing to trade in and yet prefers, for reasons of his own, or for no reasons at all, save thoughtlessness, to hide his light under a bushel. This, however, is a digression which can only claim to have any bearing upon the subject of Manchester Exhibition in so far as it goes to show that the present Exhibition affords an opportunity for setting the said light (or motor, or whatever it be) on a hill.

Exhibition Lighting.—The Union Electric Co., Ltd., Park Street, S.E., have received from the President and Council of the Royal Cornwall Polytechnic Society a letter expressing their appreciation of the illumination of the Mining Exhibition held at Camborne last month, and thanking them officially for the loan of the apparatus and lamps used for the purpose, "which in a great measure contributed towards the success of this Exhibition."

ADVICE TO EXHIBITORS.

By AN OLD HAND.

Don't be for ever talking about the bad state of the electrical trade. It may reflect on *you!*

. . . . . .

Show during the whole month that in Lancashire, at any rate, the electrical trade is a very *live* affair.

. . . . . .

Don't worry your head about co-operation. It's an intoxicating subject, but there's nothing in it for *you!*

. . . . . .

Nor about a said League—it's no panacea.

. . . . . .

Weep not nor growl concerning foreign competition. Our export returns for August are record ones. The Electrical Review, on page 513, says that electrical imports and re-exports were both down, but that British exports were phenomenally high! All hands to the pump!

. . . . . .

To-day's Friday! To-morrow's Saturday! October 3rd! Opening Day!

. . . . . .

Have you got everything ready?

. . . . . .

If not, keep at it all night to-night—if they'll let you.

. . . . . .

No packing-cases in the pathway to-morrow, mind!

. . . . . .

There might be unpleasant consequences!

. . . . . .

Run your exhibit as though you meant it.

. . . . . .

First believe in electricity yourself, then talk it boldly.

. . . . . .

If an inquiring power-user twigs a want of confidence in your talk, do you expect to net him?

. . . . . .

The mill will never spin with the steam-power that is passed. Electric driving for ever!

. . . . . .

Don't be niggardly with the power. Keep things running.

. . . . . .

Make hay while the electric lights shine. There's no daylight in the Hall!

. . . . . .

Hours there will be when you can fraternise with rivals' men. The right time then. And at no other!

. . . . . .

In the words of another, "There's a time for everything, and everything in its place!" A time to arrive. A time to leave. A time to dance, and a time to ——— but don't be for ever crossing (to) the bar!

. . . . . .

Study the visitor. Don't worry him. But be diplomatic! Don't tell him too much till you are sure of your man and his mission.

. . . . . .

Don't treat him as an intruder. Nor kow-tow to him. Nor lick his boots! Treat him with dignity; with reasonable consideration; and with gentlemanly courtesy.

. . . . . .

Don't let him look at things for long without a word from you.

. . . . . .

He may go to another stand where they *do* want him.

. . . . . .

Don't smoke cigarettes as you talk. A cloud or two in his face may put upon his mind a cloud of prejudice against your firm.

. . . . . .

You know you can't handle apparatus or machinery, take it to pieces, smoke a cigarette, and talk well—all at once. Two hands and a tongue free!

. . . . . .

You can have smoke enough and to spare without annoying anyone.

. . . . . .

Don't howl all the time about the cost of your exhibit. You know it paid you well enough at Olympia—if you were there.

. . . . . .

You want the *right* people there. Send out your circulars and tickets into the highways and by-ways. Compel them to come in!

. . . . . .

Inter alia, draw all electrical men to Manchester once or twice during the run. Put your stand number in your Review advertisement every week and tell what you're showing!

. . . . . .

Resolve that the Exhibition spirit shall lead you on to bigger enterprise.

. . . . . .

To end as we began: Don't be for ever talking about the bad state of the electrical trade.

. . . . . .

Some things have a knack of becoming what we say they are.

Printed by William Cate, Ltd., Hogarth House, Bouverie St., and Published by the Proprietors, H. Alabaster, Gatehouse & Co., at 4, Ludgate Hill, London.

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"REALLY RELIABLE."

Their Application and Great Advantages

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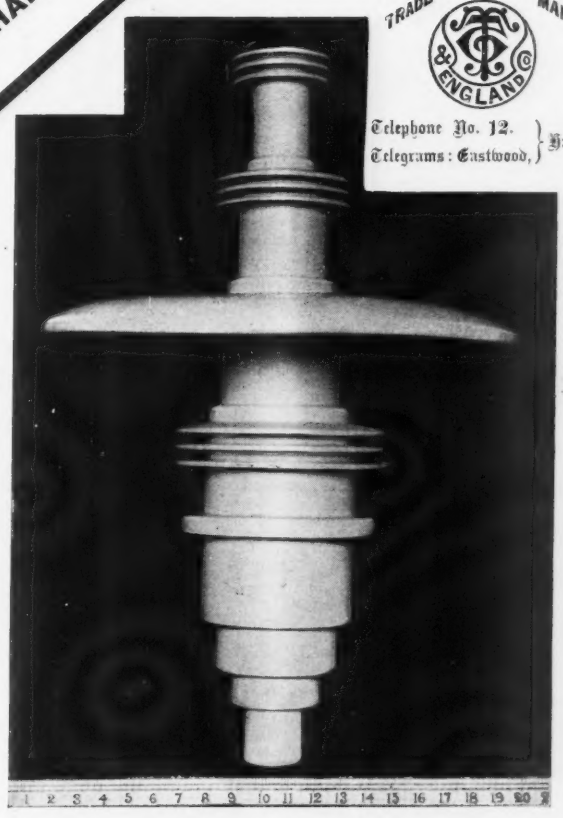
PORCELAIN MANUFACTURERS, EASTWOOD, HANLEY.

London Offices: 25, Holborn Viaduct, E.C.

Established 1867.

ELECTRICAL TRADE MARK

Telephone No. 12. Telegrams: Eastwood, } Hanley



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OBLONG AND ROUND CUT OUTS,

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BELL PUSH ROSES, LEADING IN TUBES, &c.

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Form a great trade paper, the recognised organ of the cotton trade. They afford engineers an exceptional opportunity of publishing facts and arguments about their goods for the information of the mill owners, merchants and shippers of Lancashire. With the help of this publicity a good connection can be built up in Lancashire with half the difficulty and expense it cost previously before the Commercial Pages of the "Manchester Guardian" were available.

The ELECTRICAL EXHIBITION at Manchester.

Whether exhibiting or not, it is a wise thing during the period of the Exhibition to publish the particulars of and arguments for your goods alongside the reports of the Exhibition in the "Manchester Guardian." Electrical developments are being carefully watched by Lancashire mill owners, and our Commercial Pages form the trade paper of Lancashire industries. Write for rates to Advt. Dept.

JOHN MUSGRAVE & SONS, Ltd.

ENGINEERS, BOLTON,

ARE SHOWING AT THE

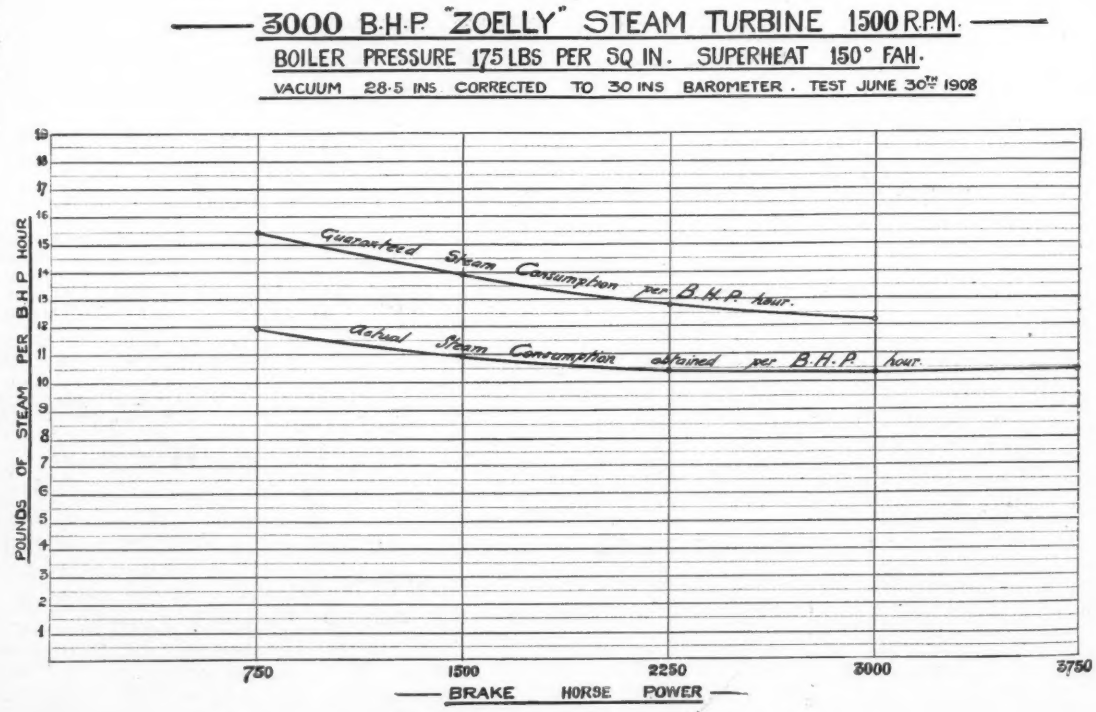
Manchester Electrical Exhibition,

STAND No. 53,

The first **'ZOELLY' STEAM TURBINE** which has been

ENTIRELY MANUFACTURED IN ENGLAND.

Output 600 kw. at 3000 r.p.m.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VACUUM 28·5 INS CORRECTED TO 30 INS BAROMETER. TEST JUNE 30TH 1908
POUNDS OF STEAM PER B.H.P. HOUR
Guaranteed Steam Consumption per B.H.P. hour.
Actual Steam Consumption obtained per B.H.P. hour.
750
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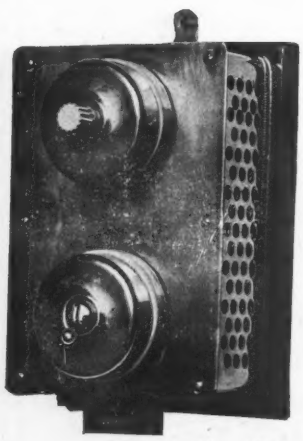

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2—5 Lights.
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7—11 Lights.
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Diameter - - 4 inches.

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¶ No internal wiring.
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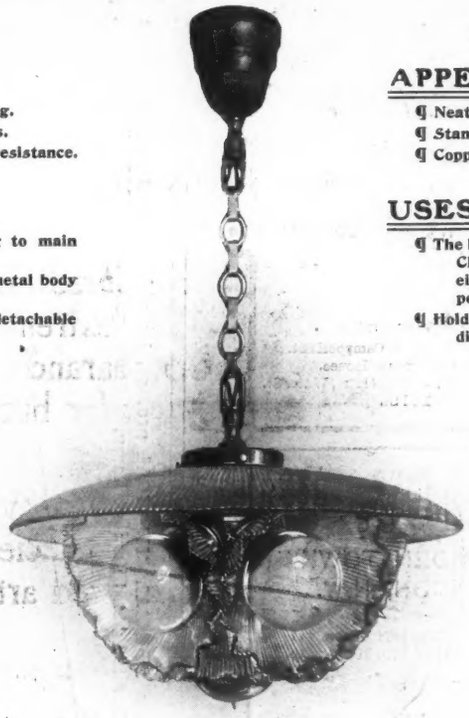

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1—3 Lights.
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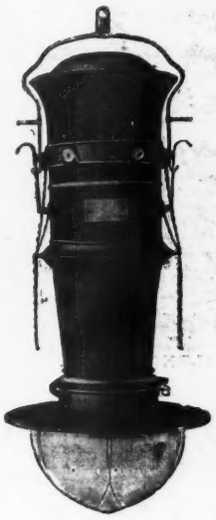

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WESTINGHOUSE Enclosed-Arc for a.-c. and d.-c. circuits of extremely simple construction and handsome appearance. Perfectly reliable. Sizes 3 to 7 amps. for burning 60 to 70 hours.

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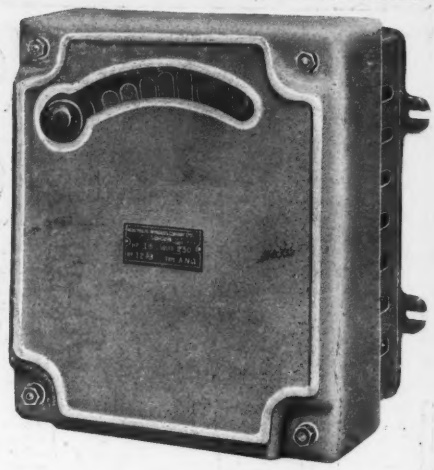

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CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Adelaide.—November 20th. The City Council requires tenders for the supply and erection, complete, of a refuse destructor, electric lighting plant for same, &c. Particulars may be obtained from the Agent-General for South Australia, 1, Crosby Square, Bishopsgate Street Within, E.C.

Melbourne.—The Postmaster-General of the Commonwealth requires tenders for the supply and erection of installations for wireless telegraphy at the following places:—Launceston; King Island (Bass Straits); Flinders Island (Furneaux group); Melbourne. See "Official Notices" September 18th.

Tasmania.—March 15th, 1909. Postmaster-General. Telephone switchboard, common-battery system and apparatus for use at subscribers' premises, Launceston. Specifications and particulars of general conditions can be inspected at the offices of the Electrical Review.

Melbourne.—October 13th. 770 electricity meters and 157 maximum demand indicators, for the City Council. See "Official Notices" September 25th.

Melbourne.—October 20th. 60 D.C. flame arc lamps for the Council. See "Official Notices" to-day.

Cape Colony.—November 18th. Dry cells in quantities from July 1st, 1909, to June 30th, 1910, for the Government. Information from Controller of Stores, G.P.O., Cape Town, to whom six sample cells should be sent. All tenders must be on printed forms supplied for the purpose. A fuller notice appeared in the *Board of Trade Journal* last week.

Constantinople.—The Post and Telegraph Department requires tenders for 8,500 miles 4 mm. steel wire, 15,000 Leclanché insulators, and 1,360 other insulators. A deposit of 10 per cent. is to be made by a local agent.

Egypt.—October 29th. The Ministry of the Interior wants tenders for the installation of electric lighting in the town of Zagazig, in accordance with specifications and plans that may be inspected at the offices of the above Ministry at Cairo.

France.—Paris.—October 13th. Multiple switchboard for the central exchange, Paris. Apply to the Sous-Secretariat d'Etat des Postes et des Télégraphes, Rue de Grenelle, 103, Paris, before October 3rd.

Germany.—Cologne.—The municipality is about to invite tenders for the supply of four 3,000-H.P. turbines for the electricity works.

Hirschberg.—Tenders are about to be invited for the installation of electricity at the municipal high school for girls, at a cost of 380,000 marks.

G.W. Railway.—October 20th and November 10th. Stores for the G.W. Railway. See "Official Notices" to-day.

Leeds.—October 14th. Materials for tramway construction for the Tramways Committee. See "Official Notices" to-day.

Limerick.—October 2nd. Two additional switchboard panels for the E.L. Committee. See "Official Notices" September 25th.

London.—October 13th. Six fuel economisers, 320 tubes each; three electrically-driven feed pumps, 9,000 gals. per hour each; and two 5,000-KW. horizontal steam turbo-generators, for the L.C.C. See "Official Notices" September 18th.

October 5th.—The Metropolitan Railway Co. invites tenders for general stores for one year, including electric wires and cables, also electric lamps, carbons, fuses, ebonite, battery jars, zincs, &c. Tenders to Secretary, R. H. Selbie, 32, Westbourne Terrace, W.

October 27th.—12 water-tube boilers with mechanical stokers, superheaters, &c., for the L.C.C. See "Official Notices" to-day.

Mountain Ash.—October 5th. Sub-station at Ynysybwl, switchgear, transforming apparatus and overhead distributing mains for the U.D.C. B. J. Day, consulting engineer, 3, Park Place, Cardiff.

Rochdale.—October 15th. Erection of overhead bare copper cable at the workhouse. See "Official Notices" to-day.

Salford.—October 5th. Electric wiring of the Halton Bank Council School, Pendleton, for the Salford Education Committee.

October 12th.—The Electricity Committee invite tenders for vertical steam feed pumps. See "Official Notices" to-day.

Spain.—October 10th. The municipal authorities of San Mateo (province of Castellon) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years. Conditions may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de San Mateo (Castellon).

War Office.—Stores, &c. See "Official Notices" September 25th.

Warrington.—October 7th. Flame arc lamps for the Corporation. See "Official Notices" September 25th.

Watford.—October 6th. 500-KW. turbo-alternator, surface condenser, switchboard panel, economiser and high-speed fan engine for the U.D.C. See "Official Notices" September 18th.

CLOSED.

Burnley.—The Guardians have appointed Mr. J. Rawlinson to supply all electrical requirements during the ensuing half-year.

Croydon.—The Corporation has accepted the tender of Messrs. Casperd & Co., Croydon, at £151, for the lighting of its new swimming bath.

Hebden Bridge.—The Secondary Education Committee has accepted the tender of Messrs. Gatley & Co., Water Street, Todmorden, for installing the electric light at the secondary schools.

London.—Blackfriars Power Station.—The Postmaster-General has just given his decision in regard to the equipment of the new Blackfriars power station, and as a result, the steam turbines, surface condensers, &c., are to be supplied by Messrs. Willans & Robinson, Ltd., and the alternators, water strainer, &c., by Messrs. Dick, Kerr & Co. Messrs. Willans and Robinson, Ltd., are the main contractors for this plant, and the contract price is £24,191.

Portsmouth.—The E.L. Committee of the T.C. has accepted the tender of the Edison & Swan Co. for a year's supply of carbon filament incandescent electric lamps for street lighting.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERCARN (Mon.).—Proposed new public institute (£4,000).

ABERDEEN.—New hall for South Parish Church (£759); Rev. G. S. Peebles, minister, South Parish Church. Two houses, Grampian Road, for Mrs. J. Macintosh; Sutherland & George, architects, Aberdeen. Two houses, Holburn Street, for W. H. Alexander, contractor, Cluny; Sutherland & George, architects. House, Clifton Road, for G. D. Mackenzie, granite merchant. House, Burns Road, for R. F. Nicol, gardener; J. Buchan, architect, Broomhill Road, Aberdeen. Proposed extensive additions to the City Hospital (£12,500); Mr. Rust, city architect, Aberdeen.

ABERTILLERY.—Class rooms at Six Bells.

ALDERSHOT.—Conversion of Aldershot Park Mansion into high-class social and sporting club. Marquis of Winchester, Chairman of the Committee.

ANDOVER.—New premises in Bridge Street. Local Co-operative Society.

ASCOT.—Country residence on the Quilter Estate, Sunninghill; F. Pizzey builder, Sunninghill. Two large villas, Kennel Ride; W. Watson builder, Ascot. Additions to Heatherdown for Mr. Churchill.

ASHBOURNE.—House at Hollington, near Ashbourne. W. Buckley.

AYLESBURY.—Houses, Tring Road, for T. Green. Additions to houses for Mr. Randall, Queen Street, and F. Longley, The Croft, Walton Road.

BANBURY.—New school at Grimsbury, for the Borough Education Committee W. Talbot Brown & Fisher, architects, Wellingborough.

BARNARD CASTLE.—Enlarging and improving East and West Whorlton schools, for the Northumberland Education Committee. H. Williams, secretary, Moot Hall, Newcastle-on-Tyne.

BARNSLEY.—Houses, St. John's Road, for Walter Midgley; Dodworth Road for E. H. Wakefield; Granville Street, for A. Heaversedge; Dodworth Road, for Geo. Haigh; Pogmoor Road, for John Mellor; Richmond Street, for Wm. Robinson; Denton Street and Vernon Street North, for G. H. Gray; additions to premises, May Day Green and Queen's Road, for J. Barraclough & Sons. Three villas in Shaw Lane; W. T. Turner, architect, Market Hill. Six houses, Peel Street, Worsbro' Common; W. Kell, architect, 1 and 3, Eastgate, Barnsley. Houses, Lancaster Street; W. T. Turner, architect, Market Hill, Barnsley.
Extension of the wholesale market shops by the T.C.

BATLEY.—Four houses in Pearl Street, Batley; G. & J. Mortimer, contractors, Batley. New club in Ings Road, for Carlinghow Working Men's Club. Secretary, Carlinghow Working Men's Club.

BEDFORD.—Houses, Spenser Road, for W. T. Glass, builder, 85, St. Leonard's Avenue; Denmark Street, for D. Francis, builder, 65, Foster Hill Road; Pemberley Crescent, for A. W. G. Prosser, architect, 90, Kimbolton Road; Dudley Street, for W. Braybrook; Beverley Crescent and Southville Road, for T. Goldsmith, builder, Ampthill Road; Sidney Road, for R. Jeakings, builder, 128, Hurst Grove; Rosamond Road, for H. J. Jones, builder, 131, Castle Road; Gladstone Street, for E. Casbeard, builder, 92, Gladstone Street; additions to house, Bromham Road, for J. P. White, builder, Bromham Road; additions to house, 84, Midland Road, for H. Young; additions to Conservative Club, St. Peter's Street; offices, High Street, for Wells & Co.

BELPER.—New Post Office in Strutt Street. Surveyor, Belper District Council.

BERKHAMSTEAD.—Alteration of the Lamb Inn, Wigginton, for Locke and Smith, Ltd., brewers, 160, Camden Street, N.W.

BILLINGSHURST (Sussex).—Proposed Cottage Hospital for Kirdford and district.

BINGLEY.—Additions to Britannia Mills. S. Jackson & Son, architects, Tanfield Chambers, Bradford.

BIRKENHEAD.—New Hall and Sunday Schools in connection with Brunswick Wesleyan Church (£2,800); Smith & Matley, architects, Manchester. New premises, Laird Street; Manchester Co-operative Society.

BIRMINGHAM (Sparkhill).—New Roman Catholic Church and Schools, Stratford Road. Rev. Father O'Hagan, 254, Stratford Road, Sparkhill.

BISHOP'S STORTFORD.—Nonconformist College extension. H. G. Ibberson, architect.

BLANDFORD.—New Wesleyan school-room at Stalbridge.

BRADFORD.—New skating rink. Promoter, F. A. Wilkins, Whitechapel, Liverpool; Butterfield and Hartmann, secretaries of company, Darley Street, Bradford.

BRENTFORD.—Extensions to the Nurses' Home at the Infirmary. W. H. Ward, architect, Paradise Street, Birmingham.

BRISTOL.—Proposed new workshops at Avonmouth Dock, for J. Shearman and Co., Ltd., engineers, &c.

BROADSTAIRS.—Projected new church at Reading Street.

BROMSGROVE.—Two houses in Sandhills Road, Barnt Green, for W. H. Dyer, Alvechurch; three houses at Hunnington, for A. Timmins.

BURGHEAD (Morayshire).—Dwelling house in Dunbar Street. C. C. Doig, architect, 147, High Street, Elgin.

BURNLEY.—Rebuilding the Victoria Theatre (seat 3,000). B. Crewe, architect, London. Place of worship; W. Wilkinson, builder, Burnley. Railway developments and alterations, L. & Y. Railway Co., Hunt's Bank.

BURTON-ON-TRENT.—Extensive new business premises for J. Ellis & Son, clothiers.

BURY.—Twenty-six houses in Lowes Road, Littlewood Cross, and seven in Rochdale Road. Borough engineer, Bury.

BURY ST. EDMUNDS.—Twenty-four almshouses in College Lane for the Guildhall Feoffment Trust, 51, Abbegate Street, Bury St. Edmunds.

BUSHEY.—Extension to Merry Hill County Council School. M. A. Smith, county surveyor, Hatfield.

CAMBRIDGE.—House, Buckingham Road; A. S. Ramsey, 71, Chesterton Road, Cambridge. Additions, West Street, for King's and Clare Cricket Club. Laundry, 86, Castle Street, for Mrs. Brown, Alpha Road, Cambridge. Three houses, Barnabas Road; E. Willmott and Sons, 12, Hope Street, Cambridge. House and laundry, Madingley Rise; H. F. Newall, Madingley Rise. Laundry, Coldhams Lane, for Coldham Laundry Co., Cambridge.

CARDIFF.—Fireproof warehouse in Bridge Street, Cardiff, for J. Maitland Watkins; Bruton & Foster, architects, 119, Queen Street, Cardiff. Congregational chapel in Penywain Road; Habertson and Fawckner, architects, Cardiff. Alterations at Cardiff Exchange; E. Seward, architect, Cardiff. Extensive additions to Red Lion Hotel; Feather & Wilson, architects, Cardiff. Extension to Minnie Street Laundry for Cardiff Steam Laundry Co.; H. Budgen, architect, Cardiff. Mission Hall, Planeswydd Road, for Presbyterian church; G. Hallett, architect, Cardiff. Four houses, in Fairfield Avenue, for G. F. Pugsley; Veall & Sant, architects, Cardiff. Four houses in Llanishen for I. Johns; Veall & Sant, architects, Cardiff. Three houses in Waterloo Road for Geo. Partridge; W. H. Scott, architect, Cardiff.

CARNFORTH.—Garage and workshop for the Carnforth Cycle and Motor Co.

CARSHALTON.—Shops and stables, High Street, for Mr. Langley; houses, Hawthorn Road, for Windebank & Co.

CASTLEFORD (Yorks.).—Houses, shop, &c., Smawthorne Lane, for I. Sanders; J. P. Padgett, architect, Charlton Chambers, Castleford.

CHEADLE HULME (near Stockport).—Houses, Victoria Avenue, for Mr. Gradwell; Hill Top Avenue, for W. Rhodes.

CHESTERFIELD (Barlborough).—Extension of the Barlborough Council School and master's house; G. H. Widdows, architect to the Derbyshire Education Committee, County Education Offices, St. Mary's Gate, Derby.

CINDERFORD (Glos.).—Primitive Methodist Sunday School premises.

CIRENCESTER.—House, &c., Dyer Street, for C. Baldwin; laundry, 9, Apsley Terrace, for Mrs. Darling.

COALVILLE (Leicester).—Proposed market buildings in High Street. Wyggeston Hospital Trustees.

CREWE.—New sewage scheme (£70,000 or £80,000). Borough engineer, Crewe.

CROMPTON (Lancs.).—New co-operative stores and bakery. J. H. Mills, architect; Mr. Isherwood, builder, Oldham.

CROYDON.—Thirty-seven houses, Nutfield Road; W. M. Lucas, 91, Brigstock Road, Thornton Heath. Six houses, Totton Road; G. Atkins and Sons, Pollards Hill. Two houses, Johnson Road; S. G. Gee, builder, 147, Mackenzie Road, Sydenham. Rebuilding the Theatre Royal; E. W. Kirk, Nottingham. Six houses, Galpins Road; A. L. Dartnell, 84, High Street, Croydon. Six houses, Shirley Road; P. Crowley, Burlington Road, Croydon. Two houses, Radcliffe Road; Worsfold & Sons, builders, 1, Tunstall Road, Croydon.

DERBY.—New Baptist Church at Kilbury. Harris & Hunt, builders.

DEWSBURY.—New textile department at the Endowed Schools; J. Lane Fox, architect, Bond Street, Dewsbury. Two electric fans for the Batley Carr Working Men's Club. Thirteen houses, Batley Carr; W. H. Summers, Common Side.

DINNINGTON (near Rotherham).—Houses, Lorden's Hill, for C. R. Revill; houses and shop, New Street, for F. E. Revill and W. Davenport.

DONCASTER.—Rebuilding of business premises, for W. Burdett & Son, jewellers, 16, French Gate; prospective re-building, after fire, of Woodhouse & Co.'s brass works, Hexthorpe.

DUNSTABLE.—Houses, Downs Road, and Great Northern Road, for Mr. Horn; High Street South, for R. Lester.

EASTBOURNE.—House in Nevill Road, Hampden Park; E. G. Noakes, builder. House in Rosebery Avenue, Hampden Park, for H. C. Martin; Mitchell & Ford, architects, Eastbourne.

EAST CLAYDON (Bucks.).—New County School and houses. C. G. Watkins, Education Offices, Aylesbury.

EASTLEIGH (Hants.).—Twenty houses, Archer's Road, for E. H. White; house and shop, Doncaster Road, for Pitfield Bros.

EGHAM.—Houses, Glebe Road, for W. Tidbury and E. J. Bloyce; Thorpe Lea Road, for A. J. Ward.

ELLAND.—Secondary school in Victoria Road. West Riding Education Committee.

EPSOM.—House, Woodcote Park Road, for W. T. Cresswell; Albert Road, for Moxham & Brown; Hylands Road, for Mr. Trower.

ERDINGTON (Birmingham).—New St. Margaret's Mission Church (£1,750). D. Hoyland, architect, Walbrook, London, E.C.

FENNY STRATFORD.—Houses, Oliver Road, for Mr. Tranfield.

FLUSHING, MYLOR (Cornwall).—Reading room on the estate of Major the Hon. H. W. F. Trefusis. Carder & Carder, architects, 4, Princes Street, Truro.

FRESHFIELD (near Liverpool).—Club premises for the Liverpool Banking and Insurance Golf Club; Haigh & Thompson, architects, Liverpool; W. H. Foster, builder, 41, Shakespeare Street, Southport.

GOLCAR.—Houses, Wellhouse; Lunn & Kaye, architects, Milnsbridge. Longcroft Road; Arthur Shaw, architect, Golcar.

GOSPORT.—New schools in Grove Road for the Gosport and Alverstoke Education Committee. Geo. R. Walker, secretary, Education Offices, Gosport.

GUISBOROUGH.—Houses, Bennison Street, for H. Langburn.

HARROGATE.—Twelve pairs of Primitive Methodist orphan homes.

Houses, Norfolk Road, for Raworth Bros.; Birch Grove, for D. Sayner; Church Avenue, for C. A. Nettleton, builder; Burke Street, Bilton, for J. E. Smith; King Edward's Drive, for C. E. Booth; mission room, Grove Park Terrace, for the Vicar of Christ Church.

HASLINGDEN.—Proposed new Conservative Club premises.

HENSINGHAM (Cumberland).—Hospital ward, &c., for the Galemire Joint Hospital Committee. Geo. Boyd, engineer, 33, Queen Street, Whitehaven.

HOLMFIRTH.—House, Hey End, for Alex. Stockwell.

HOUNSLOW.—Two villas, semi-detached, Bulstrode Avenue. W. J. Parker, architect, 28, Great James Street, Bedford Row, W.C.

HULL.—Church hall and class-rooms, in connection with Wycliffe Congregational Church (£2,000). Enlargement of Madeley Street baths for the T.C. (£8,300).

(Hadon).—Restoration of the Parish Church (£1,000). J. Bilson, architect, 23, Parliament Street, Hull.

HURST (near Ashton-under-Lyne).—Houses, Smallshaw Lane, for Wm. Adams.

ILFORD.—Houses, Baden Road, for G. H. Woodruff; Barley Lane, for Hammond and Miles, builders, Scrafton Road, Ilford; Auckland Road, for M. T. Baker; B. Bailey & Co., architects, 5, Cranbrook Road, Ilford. Enlargement of Valentine's School; Mills and Boucher, builders, Ilford.

HECKMONDWIKE (Yorks.).—Houses, Longfield Road, for Tom Horsfall.

HULL.—Two Wesleyan mission halls (£23,000).

IPSWICH.—Wireless telegraph station for the Admiralty.

KENDAL.—Rebuilding of premises, Highgate, for John G. Bland, cabinet-maker.

KINGUSSIE.—Villa in West Terrace, for Mr. Brown, Nuide.

KIVETON PARK (near Sheffield).—Officials' houses, Waleswood Colliery, for Skinner & Holford; houses, Doe Quarry Lane, for Pardoe and Robinson.

LINTHWAITE.—House and shops, Causeway Side, for L. Walker; houses and shops, Manchester Road, for the Co-operative Society; shops, Hoylehouse, for F. Quarmby; house, Pymroyd Lane, for H. Shaw; additions to house, Clough House, for Herbert Mallinson.

LOCKWOOD (Yorks.).—Detached house, Woodside Road. J. B. Abbey and Son, architects, 34A, New Street, Huddersfield.

LONDON (Willesden, N.W.).—Motor garage and stores, Acton Lane; G. A. Sexton, architect, 42, High Road, Kilburn, N.W. Formation of new road, off Belton Road; Trant, Brown & Humphreys, architects, 332A, High Road, Kilburn, N.W. Shop fronts, 188-190, High Road; Mays & Sons, builders, 8, Station Road, Kensal Green, N.W. Alterations, shop premises, 153, High Road, Kilburn; W. Benett, architect, 13, Dollis Park, Church End, Finchley, N. Alterations, Coronet Laundry, Alric Avenue, for Coronet Laundry, Ltd. Alterations, two houses, Chatsworth Road, Willesden Green; C. W. Cave, estate agent, 43, Harvard Court Road, Hampstead, N.W.

(Barking, E.).—Blacking room for the London Scottish Foundry, Ltd., London Road, Barking. Bone store and cooperage at Creeksmouth, for the London Butchers' Hide and Skin Co., Ltd., Creeksmouth Road, Barking.

(E.C.).—Additions, 26, Throgmorton Street. W. C. Jones, 32, Bedford Row, W.C., architect.

(Rotherhithe, S.E.).—Addition to vat house, Vinegar Brewery Co., Church Street, Tower Bridge Road. J. M. Kennard, 13, Railway Approach, London Bridge, architect.

(Barnes, S.W.).—Twenty-four semi-detached villas, Lonsdale Road, for C. W. Jordan; five houses, Glendower Road, Mortlake, for C. Ellis & Co.

(Ealing, W.).—New hospital; Hall-Jones & Cummings, architects, Parliament Mansions, Victoria Street, S.W. New hall and skating rink for "Walpole Hall, Ltd.," in Bond Street (about £2,000); Alfred Burr, 85, Gower Street, W.C., architect.

(Holborn, W.C.).—Additions, 8, Harpur Street. Robertson and Barton, surveyors, 75, Chancery Lane.

(S.E.).—Addition, Bankside Generating Station, Southwark, for City of London Electric Lighting Co., Ltd.

(Hendon, N.W.).—Two villas, Hampstead Way; Scrutton and Crebbin, builders, Beckton Road, E. House, Willefield Way; M. Bunney, architect, 23, Queen Anne's Gate, S.W. Four detached houses, Templars Avenue; R. V. Hart, builder, Burgess Park, N.W. Factory, Colindale Avenue; A. J. Staines and Co., builders, 154, Great Tichfield Street, W. Eight new roads on Beddington Estate; W. Hollis, surveyor, Church End, Finchley, N. Two houses, Garden suburb; M. Bunney, architect, 23, Queen Anne's Gate, S.W. House, North End Road; C. B. King, builder, 28, Church Row, and 20, Heath Street, Hampstead, N.W.

(Lewisham, S.E.).—Seventeen houses, Algernon Road; S. J. Jerrard & Sons, builders, 40, Loampit Vale, Lewisham, S.E. Six double houses and rebuilding of cowshed, Bromley Road, Southend; Jas. Watt, builder, "The Lodge," Bromley Road. Proposed church in High Street; Kelly & Dickie, architects, 466, Oxford Street, W. Addition to Boys' School, Northbrook Schools, Taunton Road, Lee; A. H. R. Tenison, architect, 12, Little College Street, Westminster, S.W. Five houses, Chalcroft Road; W. J. Scudamore & Sons, builders, 13, Manor Lane, Lee, S.E. New street from Herne Hill Road to Dane Avenue; R. Ellis & Son, surveyors, 45, Fenchurch Street, E.C.

(Tottenham, N.).—Iron building for box factory, for A. & W. Flatau & Co.; T. W. Palmer & Co., 5, Victoria Street, S.W. Twelve houses, Wargrave Avenue; E. Evans, auctioneer, 253, Lavender Hill, S.W. Office and sheds at Hampden Road; A. Porter, builder, 100 and 102, High Road, Tottenham. Warehouse, 544, High Road; Treacher & Son, architects, 73, Moorgate Street, E.C. Workshop, at 247, West Green Road; Brand, Pettit & Co., builders, 247, West Green Road, N. Four houses, Rostrevor Avenue; Leeks & Blake, care of E. Evans, 253, Lavender Hill, S.W. Iron Mission Hall, St. Francis de Sales, Brereton Road, for Rev. Father J. F. Subra.

(Walthamstow, E.).—Mission Hall, Cavendish Road; W. Harbrow, builder, South Bermondsey Station, S.E. Thirteen houses, Marten and Cazenove Roads; H. Brodey, architect, 259, High Street, Walthamstow, N.E. Paint store, Blackhorse Lane; P. Hooker, Ltd., engineers and ironfounders, Blackhorse Road, Walthamstow, N.E.

(Merton, S.W.).—Proposed sub-Fire Station at Raynes Park. Surveyor, Merton Urban District Council.

(E.C.).—Proposed buildings in City Road, for the German Y.M.C.A. (£25,000).

LONGTON.—Proposed High School for Girls, at Park House, Tettenhall Road. G. Balfour, Director of Education, Staffs. Education Offices, Stafford.

LOWESTOFT.—Five houses, May Road; A. Clark, architect, 26, London Road, Lowestoft. Dwelling-house, London Road South; R. C. Todd, builder, Kendal Road, Kirkby, Lowestoft.

LYNTON.—Roman Catholic Convent in Lee Road (electric light to be used).

LURGAN.—Re-building and additions to shops and dwelling-houses in Market Street, for Miss Taylor. Hobart & Heron, architects, Scottish President Buildings, Belfast.

MANSFIELD.—New St. John's Mission Hall in Broomhill Lane.

MARGATE.—Re-building the General Post Office, Cecil Square.

MARLBOROUGH.—New Post Office. Thos. Leadley, contractor, Marlborough.

MIDDLETON (Lancs.).—Proposed elementary school in Durnford Street (1,000 scholars). E. Wood, architect, 78, Cross Street, Manchester.

NELSON (Glam.).—Extension of Llanfabon Church (£1,200). E. M. B. Vaughan, architect, Cardiff; Knox & Wells, builders, Cardiff.

NEWPORT (Mon.).—New church at Wattsville, Cross Keys.

NORTHFLEET.—Dover Road and Lawn Road schools to be enlarged for the Kent Education Committee.

NOTTINGHAM.—New Baptist Mission Church (£2,350), corner of Robin Hood Chase and Raglan Street. W. A. Coombs, hon. pastor.

OTLEY (Yorks.).—Probable reconstruction (after fire) of premises for J. Hepworth, Ltd., clothiers, Leeds.

OUNDLE.—Houses, New Road, for Mr. Tebbutt; Herne Road, for Mr. Freeman.

PLYMOUTH.—New Catholic Church at junction of Holland and Whitworth Roads, Mutley. Rev. Canon Scoles and G. Raymund, Basingstoke, joint architects.

PONTARDAWE (Glam.).—New collieries to be opened. South Wales Primrose Colliery Co.

Cross Inn to be rebuilt.

PORTHCAWL (Bridgend).—Proposed new church on site of All Saints' Church.

PORTSMOUTH.—Three houses, Bevis Road; E. W. J. Payne, 6, Munster Road. Landport. Stores, for the Waterproof Glue Co., Chandos Street; J. Croad, 47, Union Street and Portland Street, Landport. Houses, Twyford Avenue; W. H. Dugan, 1, Northern Parade, Landport. House and shop and stores, in New Road; J. Macklin. Additions to 43, Havelock Road, for Rev. E. Bruce Cornford; Jas. Crockerell, builder, Victoria Road North, Southsea. House, Chichester Road; A. Chase, 22, Porchester Road, Landport. New Roman Catholic Church, Copnor Road; Jenkins & Co., builders.

PRESTON (Kirkham).—New elementary school (£3,000). H. Littler, County Architect, Preston.

PUDSEY.—Motor shed at Smalewell Road, for J. S. Boyd; extensions to warehouse in New Street, for the Pudsey Worsted Mill Co.; house at Varley Street, for J. W. Barnes.

RADCLIFFE.—Probable rebuilding, after fire, of Phœnix Mills.

RAMSGATE.—Houses, West Cliff Road. Woodhall & Son, builders, Boundary Road, Ramsgate.

RETFORD.—Criminal lunatic asylum (900 inmates), and 100 cottages for attendants, at Rampton; alterations and additions to premises, for the Nottingham and Notts. Banking Co., Ltd.

RICHMOND (Yorks.).—Probable re-erection of business premises (after fire), for Messrs. Bainbridge, drapers, Market Place.

ROCHDALE.—One hundred and seventy-six new houses. Borough engineer, Rochdale.

ROTHERHAM.—Alterations, &c., to Woodsetts Provided School. J. Vickers-Edwards, County Architect, County Hall, Wakefield.

RUGBY.—Houses, Murray Road, for A. P. Hawkin; workshop, &c., for the Governors of the Lower School of Lawrence Sheriff.

ST. BURYAN (Cornwall).—United Methodist Sunday School. J. T. Jelbart, builder, St. Buryan.

ST. HELENS.—Houses, Leach Lane, for John Marsh; Robin's Lane, for Wm. Bate; additions to house, Fleet Lane, for Greenall, Whitley and Co., brewers.

ST. IVES.—Terrace of houses, Lower Barnoon, for Edwin Williams.

SAFFRON WALDEN.—New Rectory at Debden.

SALISBURY.—Proposed isolation hospital in connection with the Salisbury and District Joint Isolation Hospital (£14,000). J. H. Goodman, architect, Town Hall Chambers, Reading.

SEATON CAREW (West Hartlepool).—Rocket life-saving apparatus house and watch room for the Board of Trade. Secretary, Marine Department, Board of Trade, 7, Whitehall Gardens, London, S.W.

SHEERNESS.—Nine houses in Alexandra Road, for Mr. Harrison.

SHEFFIELD.—Repairs and improvements at Catcliffe Provided School. J. Vickers-Edwards, county architect, County Hall, Wakefield.

SHERBOURNE.—New offices for Guppy & Son.

SLOUGH.—Houses, Queen's Road, for T. Perrin; Stoke Poges Lane, for C. J. Jackaman.

SOUTHAMPTON.—Workshop, Church Army Home, Commercial Road; J. F. Crook, surveyor, 39, Cambridge Road, Southampton. House, Ash Tree Road; four houses, Hillside Avenue; three houses, Castle Road; 16 houses, Desmond Road; S. C. Greenwood, surveyor, 11, Portland Street, Southampton. Additions and alterations, 37 and 38, Oxford Street; A. A. Burnett, architect, 2, High Street, Southampton. Two houses, St. James' Road; Jurd & Sanders, architects, 25, Portland Street, Southampton. Four houses, King Edward's Avenue; W. B. Hill, jun., surveyor, 81, Above Bar, Southampton. Additions to 22, Cranbury Place; T. H. Stiles, builder, 8, Albert Road, Northam, Southampton.

SOUTHPORT.—Extensions at St. Cuthbert's Church; the Vicar.

STOCKTON-ON-TEES.—House, Headlam Street, for W. Lowther. Laying out of estate, Durham Road; R. Appleton & Sons, estate agents, 134, High Street, Stockton.

STOKE.—Semi-detached villas at Oakhill; W. Ball. Shop in Union Street; C. Hackney. One house in All Saints' Road; A. Cartlidge.

STRANRAER.—New hall in King Street in connection with Shenchan United Free Church (£500). Rev. T. Russell, minister, U.F. Church, King Street.

SUNDERLAND.—Mortuary at Ryhope, for the T.C.; Stephen Hendry, Fulwell, builder. Workmen's houses at Ryhope, for the T.C. (£9,432); J. T. Parker, builder. Workmen's houses at Tunstall, for the T.C.; H. E. Pitt, builder, Sunderland.

SUTTON (Surrey).—Houses, Lenham Road, for A. Legg; Constance Road, for C. W. Snazell.

SWADLINCOTE.—Proposed Roman Catholic Church (£3,000).

SWANAGE.—Houses, Swanage Bay Estate, Parsons & Hayter; Kempstone Road, H. & J. Hardy; Hedes Estate, H. J. Smith; Cliff Avenue, J. Parsons.

TETBURY (Glos.).—New Wesleyan Methodist Church in Long Street.

TIPTON (Tividale).—New Infants' School (250 pupils). Pritchard & Pritchard, architects.

TORPOINT (Devon).—Extension of the Wesleyan Church (£1,500). Thornley and Rooke, architects, Plymouth; J. Paynter, builder, Plymouth.

TORQUAY.—Proposed pavilion in the Princess Gardens. Macfarlane & Co., architects, Glasgow.

TWICKENHAM.—Shops and houses, Edwin Road, for Hosking & Co.

UXBRIDGE.—Four houses, Otterfield Road, Yiewsley. A. H. Winterburn, surveyor, Yiewsley, Middlesex.

WALTON-ON-THE-NAZE.—Garage and premises, Churchfield Road, for J. C. Moreland.

WELLINGBOROUGH.—New church of St. Mary.

WEST KIRBY (near Birkenhead).—Rebuilding a portion of the residence of J. Cumming Macdona, M.P. (Hilbre House, Sandy Lane).

WHITEHAVEN.—Elementary school and caretaker's house for the Education Committee. W. D. P. Field, secretary, Town Hall, Whitehaven.

WICK.—New public hall at Pulteneytown.

WIGAN.—Houses, Albert Street, Newtown, for H. and H. Houghton; Wallace Lane, for Mrs. J. Brown.

WILMSLOW (Cheshire).—Council schools for 700 scholars for the C.C.; H. H. Brown, architect, 17, Dickinson Street, Manchester.

WOKINGHAM.—House, Reading Road, Finchampstead, for C. Brake; bungalow, Ellis Road, Wokingham Without, for Mrs. Franklin; house, The Avenue, near Crowthorne, for E. Fullbrook.

WOLVERHAMPTON.—Works to be re-built (after fire), for Frank H. Parkyn, Ltd., Olympic Cycle Works, Granville Street, Steelhouse Lane.

WORKSOP.—Alterations and additions to Thorpe Salvin Provided School. J. Vickers-Edwards, County Architect, County Hall, Wakefield. Forty-three houses, Devonshire Street and Harrington Street, for C. Bacon.

YORK.—Telephone installation (internal) at the Workhouse (£100). Board of Guardians.

FORTHCOMING EVENTS.

Saturday, October 3rd.—At 3 p.m. Association of Engineers-in-Charge. Visit to the National Physical Laboratory. 1.40 train, Waterloo.

Opening of Manchester Electrical Exhibition at Platts Field Rusholme.

Monday, October 5th.—Formal opening of the Manchester Electrical Exhibition by the Lord Mayor of Manchester.

Saturday, October 10th.—At 3 p.m. Liverpool and District Electrical Association Visit to Mersey Dock and Harbour Board's new offices, Pier Head Liverpool.

Tuesday, October 13th.—At 8 p.m. At the Common Hall, Hackins Hey Liverpool. Liverpool and District Electrical Association. Presidential address by Mr. H. E. O'Brien.

Wednesday, October 14th.—At 8 p.m. St. Bride's Institute, London, E.C. Association of Engineers-in-Charge. Presidential address on "Smoke," by Mr. James Swinburne, F.R.S.

NOTES.

To Exhibition Visitors.—For the benefit of our readers who may wish to run down to Manchester occasionally during the month to visit the Exhibition, we may draw attention to a programme of excursion arrangements issued by the L. & N.W. Railway for October and November. Cheap tickets are issued for the journey from Euston to Manchester by the midnight train on Fridays, October 2nd, 16th and 30th, and by the 10.30 a.m. and 4.5 p.m. trains on Saturdays, October 3rd, 17th and 31st; day excursions (11s. return), three-day (12s. 6d. return), and so on.

Bank Absorption of Electrical Undertaking.—A novelty in banking business is announced from Vienna — the projected absorption by the Vienna Union Bank of the undertaking of the International Electricity Co., of Vienna, whose troubles with the Municipal Council in former years will probably still be within the recollection of our readers. It is tolerably well known that intimate relations exist between banks and manufacturing and investment companies in Germany, Switzerland, and Austria, and that with the assistance of the banks, the financing of new electrical enterprises is, generally speaking, a comparatively easy matter. But for a credit bank to acquire an electrical concern with the definite intention of continuing it as a department of the bank, although not a manufacturing company, is a complete innovation which will be watched with interest by other financial institutions and the electrical industry. Since the International Co. was first formed in 1889, it has been in close relations with the Union Bank, which has financed the former's increases in share capital, and has had representatives on its board of directors, whilst at the same time the bank holds a large portion of the company's share capital of £625,000. Hitherto the activity of the company has been mainly devoted to the working of the Vienna station, which passed into the possession of the Municipal Council last May on payment of the sum of £833,333, thus terminating the unpleasant incidents provoked by the Council. It was originally intended to return £500,000 to the shareholders, leaving £333,333 for the promotion of new undertakings, but this idea was not proceeded with, as such works develop very slowly, and require the provision of adequate funds. The slow progress is illustrated in the case of the works in which the company is financially interested, as, for instance, the Bielitz central station, the Polswerke, the Fiume central station, and the Teplitz-Eichwald electric tramway, whilst the company also holds the concession for the erection and working of electricity works and a tramway at Budweis. These participations and the shares acquired in the Wels electricity works will consequently form the foundation of the electrical department which is to be established by the Union Bank and which will be extended by the financing of new enterprises, particularly in regard to the utilisation of water-power for the production of electrical energy by the use of the patents appertaining to the Golwig system. The transfer of the company's undertaking to the bank is to be effected by an interchange of shares on terms which are considered to be very favourable to the former, namely, £752,000 in shares of the bank for the £625,000 represented by the company's capital. The transaction is rendered easy by reason of the bank's shareholding in the company, and it will therefore only be necessary, in the first place, to issue new bank shares to the amount of £416,000.

On the other hand, the bank will become possessor of the company's cash balance of £833,333, formed of the purchase price of the Vienna central station, together with the reserve fund of £375,000, the two items making a total sum that is of considerable value in view of the present condition of the Austrian money market. It is considered that the success or failure of this banking départure will depend upon the extent to which the department will be able to act independently and have freedom of action. At any rate, the novelty of the transaction represents another instance of the co-operation of European banks in the development of electrical enterprise, and it once again demonstrates the confidence which credit banks manifest in the future of the industry.

The Aluminium Syndicate Dissolution.—A communication issued by the Neuhausen Aluminium Industry Co. states that the reason for the dissolution of the Aluminium Convention, which was foreshadowed in this journal a few weeks ago, lies in the necessity for more keenly combatting the competition which has arisen. In this connection a correspondent of a German newspaper submits that by breaking up, the syndicate will take a further step to render the market situation still more unfavourable. The price of the metal, which still amounted to from £8 10s. to £8 15s. per cwt. in the first quarter in 1907, has receded to £3 10s., and transactions are even heard of at a much lower price. Until last year the syndicate controlled the manufacture of aluminium, and utilised its monopolistic position in a way which, the correspondent states, could almost be termed "terroristic." Not only were the prices kept extraordinarily high, but rigorous conditions were imposed in regard to delivery and terms of payment. These circumstances gave occasion to consumers to encourage competitive undertakings, and works outside the syndicate have been started in the course of the past year. The Neuhausen Co., which takes the lead in the syndicate, then constantly reduced prices in the fight with the new producers, and as the latter naturally followed the example, and were even compelled to quote still lower rates, a complete overthrow has occurred in the market. It is said that prices have probably reached the limit of the cost of production, or are even below this rate in the case of some works, and this condition of affairs will presumably become worse through the dissolution of the syndicate. Of course, certain of the works maintain that they are still working at a profit, but this assertion is open to doubt. The correspondent blames the syndicate for the present unsatisfactory conditions of the market, which are damaging all producers and benefiting none of them. A further illustration of how commercially reprehensible the policy pursued by the syndicate has been, the correspondent submits, lies in the circumstance that although aluminium can be worked up easily, and has other advantages which should ensure it the widest use, its employment has remained restricted to comparatively few purposes. In his opinion it would have been far preferable, instead of devoting large sums to fighting competition, to have appropriated the money for experiments which would extend the use and sales of the metal. New applications of aluminium will, in course of time, restore a healthy relation between consumption and production, so that a natural development of the market can be foreseen provided that the works formerly syndicated do not maintain the unreasonable price policy; but even in that event the new works, which have been created by powerful groups, should be in a position to stand the price war. The correspondent concludes by remarking that the syndicate has not only indirectly occasioned the erection of new works by reason of the use of its monopolistic position, but it has also directly caused the establishment of a competitive undertaking through the withdrawal of custom from one of the suppliers of alumina, who has been compelled to build a factory in order to be able to dispose of the material forming his output.

Uniformity in Railway Working.—The battle of the systems of railway working, or rather of the variations in identical systems, seems to be commencing in Germany. A German correspondent points out in this connection the desirability that the experiments which are either in progress or in contemplation should be centralised, in order that no difficulties should be placed in the way of electrical working on ordinary railways by the employment of various systems. As an instance it is mentioned that the Baden State Railway authorities have decided to utilise alternating current of 15 periods, whereas the Prussian State Railway Administration has already adopted, the correspondent remarks, a frequency of 25. Although electrical engineers are not yet agreed that 15 periods do not yield advantages under certain circumstances, yet it might be taken into consideration that locomotives equipped with motors working at this frequency cannot be operated with advantage on lines installed for a frequency of 25. As a consequence this variation in the design of the motors would render it difficult for through traffic to be conducted between the Baden and the Prussian railways. It is therefore suggested that the various railway authorities should arrive at an understanding in the selection of systems in order to obviate unpleasant consequences at a future date.

Steel Belts.—The disadvantages coupled with belt transmission—slipping, subsequent tightening and wear—have given impetus to the search for a suitable substitute. The Eloesser Kraftband Gesellschaft m.b.H., Charlottenburg, succeeded some time ago in the adaptation of steel belts, which are produced from steel of special alloy and temper, and possess several good features. By reason of their greater strength, steel belts of smaller width than those usually employed can be applied. Good transmission is assured by the utilisation of a peculiar contact plate, accurate measurements having revealed that the slip amounts to but $\frac{1}{10}$ per cent. The same experiments show that the working loss at no time exceeds 1 per cent. In certain cases, leather belts of a width of 600 mm. have been replaced by steel belts of 100 mm. This allows of a relatively light weight for the steel belt, which, therefore, does not cause flexure, as does a leather belt. As a result, the distance between the driving and driven pulleys exercises but little influence. Steel belts lend themselves to very high speeds, trials of velocities of 62 metres per second and above having been made with success. Subsequent tightening of steel belts is not necessary, even if the original tension was such that it sufficed for the transmission of the maximum load.—*Energy.*

Regenerative Traction.—For the past 12 months there has been a lull in the development of the regenerative system, amounting, in fact, to stagnation; little has been heard of the system, and practically nothing has been done. The cause of this unfortunate pause, we understand, has been the action for infringement that was brought against Raworth's Traction Patents, Ltd., by the Johnson-Lundell Co. a year ago, and the advertisement that was then issued, warning purchasers of the former to beware of infringement. The effect of these proceedings was to paralyse the Raworth Co.'s business without affording any means of redress; no information was vouchsafed as to the precise nature of the infringement alleged, and in the end the matter has been settled by the withdrawal of the action, each party paying its own costs. The Raworth Co. has lost some thousands of pounds through this attack upon its business, negotiations that were in progress at the time having been broken off by the intending purchasers with a view to safeguarding themselves; we learn, however, that orders are now being received, and the Corporation of Rawtenstall has decided to adopt regenerative cars for the whole of its reconstructed lines. When our readers recall the fact that the Johnson-Lundell Co. is, and has long been, in financial difficulties, they will, we think, agree that the action in question was a last expiring effort on the part of that ill-fated concern to recoup its losses—at the cost of another. The dog-in-the-manger policy adopted cannot be regarded as one that reflects credit upon its originators, suggesting as it does the promptings of envy—for no grounds have been stated for the action, nor is any infringement whatever admitted by the Raworth Co. It is an unsavoury affair.

Electrical Irrigation in Spain.—The Barcelona Journal, *Industrias e Invenciones*, advocates the use of electrical energy for irrigation purposes in Spain. The great plains of Valencia, Murcia, Catalonia, and Andalucia are, it says, made fruitful by irrigation works which date from the times of the Moors, but other equally suitable districts lack these advantages. There is, however, no reason why the numerous waterfalls which exist in Spain, at present only partially utilised for electrical purposes, should not be laid under contribution for further services. Industrial utilisation is out of the question, as Spain possesses few industries; but a greater return on the capital invested in existing central stations, not to speak of the calling into being of new stations, might be facilitated by the use of electricity at pumping stations for the raising and distribution of water for irrigation. Not only the water but also the power could thus be utilised. There can be no doubt that this suggestion of our Barcelona contemporary is well advised, and that sooner or later it will find expression in practice.

A Committeeman's Resignation.—How much interest *ought* the members of a Council to take in the *working* of an electrical undertaking? What say the engineers? We have heard of some who get nothing but pettifogging interference from committeemen, but there are committeemen and committemen, as there are also engineers and engineers. It all depends! We are informed by an Irish correspondent that the chairman of the Bray E.L. Committee has resigned on the grounds that he cannot be responsible for the working of the concern owing to the lack of interest taken by the other members of the Council in its management, but the Council—whether intending to amend or worsen its ways we know not—has decided to ask him to reconsider his decision. Bray has had its system in operation since 1892. The capacity of its plant is 320 kw., and it has an engineer who, to the best of our belief, knows his business!

Post Office Telegraphs.—The report of the Postmaster-General for the year ended March 31st, 1908, shows that 85,969,000 telegrams were transmitted over the Post Office system, an increase of 3·9 per cent., as compared with the previous year. As the result of a careful inquiry into the cost of transmitting Press messages, it was found that the loss on these amounted to £225,000 annually. There was a deficit on the telegraph and telephone systems of £851,876, or £209,178 more than in the previous year. The total number of conversations over the inland trunk telephone lines was 21,993,113 during the year, an increase of 11 per cent.; the gross revenue from this service was £535,104, an increase of 11·3 per cent. The average value of each conversation was 5·84d., as compared with 5·82d., and the reduction in the charges made for trunk calls between 7 p.m. and 7 a.m. has resulted in a great increase in the traffic.

German Social-Democratic Societies.—At the last meeting of the Society of Electro-technical Installation firms in Germany, the general secretary of the Society of Associated Employers, Dr. Grabenstedt, strongly emphasised the necessity of an organisation of employers, as the question of strikes was becoming more and more important. As the most dangerous of the workmen's associations, the lecturer mentioned the Social-Democratic organisations, which in 1891 had 178,000 members and an income of £500,000, while the membership in 1906 had increased

to 1,690,000 and the income to £2,080,000. Judging from the fact that these organisations in 1906 were spending £1,360,000 for striking and agitation purposes and only £350,000 for charitable purposes, it was not difficult to see that their main object was to form fighting organisations. The lecturer recommended the Society to join the Society of German Metal Industrials and the Society of German Employers, both of which in case of strikes or fluctuation of wages render their members the most far-reaching protection.

Educational Notes.—University College.—The arrangements for the opening of the Faculty of Engineering at University College are now complete. The Provost and the Dean (Prof. J. D. Cormack) will attend on October 5th and 6th, from 10 a.m. to 1 p.m. for the purpose of giving advice and information to students entering the College. In addition to the regular courses, special additional courses have been arranged, and they include a course in Electrical Design by Mr. H. M. Hobart, a course in Railway Engineering by Mr. H. Deans, and a course in Municipal Engineering by Mr. Reginald E. Middleton. A public lecture, introductory to the special course on "The Scientific Principles of Radio-telegraphy and Radio-telephony" will be given by Prof. J. A. Fleming on October 14th at 5 p.m.

Appointments Vacant.—The Metropolitan Railway Co. is inviting applications until October 17th for the position of traffic superintendent; engine fitter for H.M. Dockyard, Sheerness (36s.) See our advertisement pages to-day.

Institution Notes.—Association of Charge Engineers.—The new Session opens on October 14th with the address of Mr. James Swinburne, who succeeds Mr. W. H. Patchell as president. Mr. Swinburne's subject is "Smoke." The following arrangements are announced:—

November 21st.—Social. Dance.
December 9th.—Paper by Mr. W. H. Booth on "Coal, its Composition and Combustion."
January 9th, 1909.—Social. Dance.
" 13th.—Paper by Mr. J. B. C. Kershaw on "Water and its Impurities."
February 10th.—Paper by Mr. H. B. Poynder on "Polyphase Motors for Machinery Driving."
February 20th.—Social. Dance.
March 10th.—Paper by Mr. W. A. Tookey on "Indicator Diagrams."
" 27th.—Annual Dinner.
April 14th.—Paper by Mr. H. Adams on "Stresses and Strains in Girder Work."
May 1st.—Social. Bohemian Concert.

Society of Engineers.—A visit was made by a number of the Society on September 22nd to the works of the New Admiralty Harbour at Dover, which were inspected by permission of the Admiralty.

Institute of Marine Engineers.—Among the arrangements for the forthcoming session are the following:—

Monday, November 2nd.—Discussion on "Electrical Transmission of Power for Marine Propulsion," at the London Institution, Finsbury Circus, E.C.
Monday, November 9th.—Lecture, "Scientific Boiler Control," by Mr. G. A. H. Binz.
Monday, November 16th.—"Some Recent Developments in Surface Condensing Apparatus." by Mr. Robert Bruce.
Monday, November 30th.—Experimental Fuel Testing.
Monday, December 7th.—"Ventilation by Induced Currents," by Mr. Robert Gregory.
Monday, December 14th.—"The Gas Engine and Producer Gas Plant for Marine Work," by Mr. E. Shackleton.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Albert Blanks, consumers' adviser to the St. Pancras B.C. electricity and public lighting department, was married recently at St. Barnabas Church, Kentish Town Road, to the daughter of Councillor Hickling, an ex-mayor of St. Pancras. The presents included a silver salver and fruit service and spoons from the electricity department.

The Coventry Electric Light Committee on Monday received and accepted the resignation of Mr. J. A. Jeckell, manager of the electric light undertaking. Previous to going to Coventry Mr. Jeckell held the post of, borough electrical engineer at South Shields. He received the appointment of manager of the Coventry electrical undertaking in 1901, in succession to Mr. G. S. Ram, at a salary of £350 per annum. This was increased to £400 on March 25th, 1903, and on September 11th, 1905, a further increase of £50 was voted, bringing up the salary to £450, at which it now stands. During the time Mr. Jeckell has had charge of the undertaking it has been converted from a losing to a paying concern.

Mr. P. Spiers, mains engineer at Kidderminster, has been appointed assistant engineer to the Stratford-on-Avon Electricity Co., Ltd., and has taken up his duties.

Tramway Officials.—The tramway staff at Bolton has presented a dressing-case and smoking requisites to Inspector E. Brindle, who is leaving tor Australia.

General.—On September 26th Mr. Lewis William Dixon, engineer and manager of the Merthyr Electric Traction and Lighting Co., was married at Scarboro' to Miss Mary Roberts. Mr. Theodore Schontheil, of Messrs. Haslam & Schontheil, of Cardiff, acted as best man.

Mr. W. Pollard Digby has removed from 82 to 28, Victoria Street, S.W., and his telephone number is 666 Victoria.

The directors of the Liverpool Overhead Railway Co., Ltd., on Tuesday appointed Mr. E. J. Neachell, M.I.E.E., A.M.I.Mech.E., as engineer and general manager, in the vacancy created by the resignation, after many years' service, of Mr. S. B. Cottrell.

Mr. E. G. Phillips, A.M.I.E.E., late chief electrical engineer to Messrs. Burroughs, Wellcome & Co., manufacturing chemists, Dartford, has accepted a similar position on the staff of Messrs. Boots, Ltd., cash chemists, and is removing to Nottingham in a few days to take up his new duties there.

Obituary.—Sir Samuel Canning.—We deeply regret having to record the death, which occurred on September 24th, of Sir Samuel Canning, whose name is probably more familiar to submarine telegraph men than to any other class of our readers. Sir Samuel was a pioneer—if not *the* pioneer, as some have described him—in this department, having been actively connected with such work almost from 1850 onwards. He was born at St. Andrews, in Wiltshire, in 1823, and had therefore reached the advanced age of 85 years. He began his career as assistant to the late Mr. Joseph Locke, F.R.S., from 1844 to 1849; he was resident engineer during the formation of the Liverpool, Ormskirk and Preston Railway, and also made the survey of the L. and S.W. Railway of their Andover to Salisbury line. In the year 1855 he laid the Cape Breton Isle and Newfoundland telegraph cable, and in 1857 and 1858 his services were secured by the Atlantic Telegraph Co. (consulting engineer, Sir C. Bright) as one of the engineers-in-charge for the laying of their Atlantic cable. In 1865 he was appointed engineer to the Telegraph Construction and Maintenance Co., and in that capacity he superintended the manufacture and laying of the Atlantic cables of 1865 and 1866. Probably his greatest achievement was the work he performed in connection with the recovery of one of those cables, a feat which he accomplished as engineer to the contractors in the *Great Eastern*. He fitted out that vessel for the purpose, and had the control of the expeditions. He also connected England with Gibraltar, Malta and Alexandria, and laid other important lines of cable connecting various countries in the Mediterranean, North Sea, &c. In 1868 he received the honour of knighthood, at the same time as a similar honour was conferred upon Wm. Thomson (afterwards Lord Kelvin). In the following year a gold medal was awarded to him by the Chamber of Commerce in recognition of his valuable services. The Insignia of the Order of St. Jago D'Espada was received from the King of Portugal. Sir Samuel acted as consulting engineer to the West India and Panama Telegraph Co., and was a co-operator with the late Mr. W. O. Callender in the first days of Callender's Cable and Construction Co. Sir Samuel's energy and brightness, as much as his kindly manner, endeared him to all who worked under him in those early days For many years latterly he had been a director of the La Guaira Harbour Corporation, and even up to the time of his death he was greatly interested in the study of tides and currents in regard to their influence upon the silting up of harbours and the practical means to be adopted for counteracting such influence. The funeral took place on Tuesday at Kensal Green Cemetery. Among those present were Lady Canning (widow), Miss Canning (daughter), Mr. Canning (son), Mr. Herbert Canning and Major A. Canning (nephews), Mr. Geo. Canning, Captain Sholto Douglas, and Mr. A. Arimayo (representing the Royal Silver Mines of Potosi, Ltd., of which Sir Samuel was a director), Mr. H. C. Clifford, Mr. Geo. Sutton, Mr. Chas. Bright, Mr. F. R. Lucas, and Mr. W. A. Hodgkinson (New Zealand). The floral tributes were numerous and beautiful. Only a few were carried with the coffin, the wreath from the officers of the T. C. and M. Co. being carried in front.

NEW COMPANIES REGISTERED.

Railway and Tramway Development Co., Ltd. (99,544).—This company was registered on September 16th, with a capital of £50,000 in £1 shares, to acquire any decrees, concessions, contracts, privileges, rights, guarantees and benefits for the construction, leasing, working or dealing with railways, tramways, light railways or other public works, to construct, establish, maintain and work any roads, electric lines, electric power and supply, mining, land improvement and other operations, &c. The subscribers (with one share each) are:—A. W. Appleby, 89, Cheverton Road, Highgate, N., clerk; A. E. Springate, 27, Parolles Road, Highgate, N., clerk; W. Parker, 5, London Wall Buildings, E.C., merchant; Mabel G. Taylor, 172, Burges Road, East Ham, clerk; T. Butt, 32, Goodmayes Avenue, Goodmayes, Essex, secretary; R. P. Glanville, 81, Poynder Villas, Isleworth, clerk; F. N. Glanville, 79, Friern Road, East Dulwich, secretary. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than seven; the first are Right Hon. Lord Teynham, Ravensdale House, Ascot; and A. Docker, 9, Grays Inn Square, W.C.; qualification, £100; remuneration, £100 each per annum (chairman £150), and 10 per cent. of the net profits after 10 per cent. is paid, divisible (maximum additional remuneration, £1,000). Registered office, 5, London Wall Buildings, E.C.

Radio and Electric Power Co., Ltd. (99,543).—This company was registered on September 16th, with a capital of £10,000 in £1 shares, to carry on the business of electricians, workers of radio-telegraphy, engineers, suppliers of electricity, manufacturers of and dealers in apparatus for automatic telegraphy and telephony, &c. The subscribers (with one share each) are:—Lt. J. H. Hills, R.N.R., 51, Burton Court, Lower Sloane Street, S.W.; A. C. Grover, F.S.A.A., St. Davids, 53, Mount Nod Road, Streatham, S.W., accountant; G. L. Bullock, 86, Forburg Road, Clapham Common, N., electrician; A. Simkins, Parel, Holden Road, Woodside Park, N., electrical engineer; A. Gray, 42, Clovelly Road, Ealing, W., engineer; E. H. Neville, 55, Gresham Road, Brixton, S.W., clerk; P. E. Hayness, Belmont, York Road, Southend-on-Sea, clerk. Private company. Table "A" mainly applies. Registered office, 102, Fenchurch Street, E.C.

Commercial and Construction Syndicate, Ltd. (99,536).—This company was registered on September 16th, with a capital of £2,000 in 1,900 ordinary shares of £1 each, and 2,000 deferred shares of 1s. each, to carry on the business of financiers, manufacturers, merchants, property owners and dealers, miners, contractors for public and other works (including steam, electric and other railways and tramways), &c. The subscribers (with one share each) are:—E. H. Moosajee, 11, Stone Buildings, Lincoln's Inn, W.C., student-at-law; E. W. Lye, 12, St. Andrew's Road, Enfield, N., warehouseman; H. F. Stanton, Kingslea, Lime Grove, New Malden, secretary; A. C. W. Dermer, 23, St. Swithin's Lane, E.C., secretary; A. H. Haines, 21, King's Villas, Cromborough Road, Tooting, S.W., clerk; R. Perry, 27, Vicarage Terrace, St. Ann's Hill, Wandsworth, S.W., clerk; F. Isaacs, 188, Willesden Lane, N.W., accountant. Minimum cash subscription, £7; the first directors are the Hon. Herbert Stanhope, F. Brady and N. Lye; qualification, 10 deferred shares; remuneration, £100 each per annum (£200 for the chairman). Registered office, 60, Cheapside, E.C.

Cordoba Light, Power and Traction Co., Ltd. (99,640).—This company was registered on September 24th, with a capital of £500,000 in £1 shares, to acquire the benefit of concessions, grants, decrees, rights and powers granted by any authority in Cordoba or elsewhere in the Argentine Republic, and to carry on the business of electric power station, waterworks, tramway, railway and omnibus proprietors, carriers, suppliers of electric light, &c. The subscribers (each with one share) are:—W. H. Jackson, 27, Miranda Road, Upper Holloway, N., accountant; H. A. Griffin, Devonport House, New Malden, clerk; A. C. Whitmee, 15, Copthall Avenue, E.C., secretary; T. F. Jackson, 62, London Wall, E.C., private secretary; G. P. P. Pleasance, 29, Braemar Avenue, Wood Green, N., clerk: F. P. Winterbotham, 6, Ladbroke Terrace, Notting Hill, W., articled clerk; F. D. M. Johnson, 24, Austin Friars, E.C., articled clerk. Minimum cash subscription, 50 per cent. of any shares offered to the public, but no public issue of initial capital contemplated. The number of directors is not to be less than three or more than seven; the first are Sir John I. Courtenay, 263A, St. James' Court, Buckingham Gate, S.W., chairman; G. Kitchin, Warnford Court, E.C.; T. F. Thomson, 62, London Wall, E.C.; and H. A. Trotter, 7, Mincing Lane, E.C.; qualification, £250 shares; remuneration, £1,500 per annum, divisible. An agreement between T. F. Jackson, for this company, of the one part, and various persons and Corporations (as vendors) of the other part, provides for the sale to this company of 3,700 shares of common stock of the Cordoba Light and Power Co. (incorporated in Maine, U.S.A.) at the rate of £20 (in shares) for each $100 share. The company is also to acquire from T. N. Vail a further 1,840 shares of the common stock, 4,840 shares of the preferred stock, and promissory notes for $126,000, the purchase consideration for these being 284,940 shares in this company. The shares and promissory notes to be acquired from Mr. Vail are, under arrangements made by him, held on account of over 70 persons and Corporations. Registered office, 15, Copthall Avenue, E.C.

Tungsten Metal Co., Ltd. (99,618).—This company was registered on September 22nd, with a capital of £40,000 in £1 shares, to acquire from the Cornish Development Co., Ltd., a leasehold factory for the production of tungsten metal (now in course of erection at Widnes), with the benefit of certain contracts for the supply of wolfram ore, &c., to adopt an agreement with the Cornish Development Co., Ltd. The subscribers (with one share each) are:—F. A. Dangerfield, Duppas Hill, Croydon, solicitor; J. L. F. Vogel, Hillersdon, East Molesey, engineer; J. Allen, 16, Eastcheap, E.C., solicitor; L. B. Oldfield, 16, Eastcheap, E.C., solicitor; A. Berney, 36, Bensham Lane, West Croydon, accountant; S. Hill, 72, Masons Avenue, Wealdstone, Harrow, clerk; W. T. Furness, 67, Britannia Road, Fulham, S.W., clerk. Minimum cash subscription 10 per cent. of the shares offered to the public. The number of directors is not to be less than two, or more than five; the subscribers are to appoint the first; remuneration, £50 each per annum (£25 extra for the chairman), and a share in the profits. Registered office, 56, Cannon Street, E.C.

J. L. Manufacturing Co., Ltd. (99,613).—This company was registered on September 22nd, with a capital of £20,000 in £1 shares, to acquire the manufacturing business carried on by the Johnson-Lundell Electric Traction Co., Ltd., to adopt an agreement with T. L. R. Cooper, and to carry on the business of manufacturers of and dealers in electric motors and dynamos and their accessories, electricians, electrical and mechanical engineers, iron, brass and metal founders, boiler makers, &c. The subscribers (with one share each) are:—F. Allen, Duppas Hill, Croydon, solicitor; T. L. R. Cooper, 20, St. Leonards Road, Ealing, engineer; H. Rottenburg, Holmhurst, Downahill, Glasgow, engineer; L. B. Oldfield, 16, Eastcheap, E.C., solicitor; J. Allen, 16, Eastcheap, E.C., solicitor; A. Berney, 36, Bensham Lane, West Croydon, accountant; S. Hill, 72, Masons Avenue, Wealdstone, Harrow, clerk. Private company: The number of directors is not to be less than two or more than five; the first are T. L. R. Cooper and H. Rottenburg; qualification, £100; remuneration (except first directors), £50 each per annum. Registered office, Johnson Street, Southall, Middlesex.

Fixarc Lamp Co., Ltd. (6,901).—This company was registered in Edinburgh on September 22nd, with a capital of £1,500 in £1 shares, to acquire from Pierre M. Capitane, electrician, 29, Rue Floreal aux Lilas, Seine, France, and from the Fixarc Lamp Co., 49, Virginia Street, Glasgow, for all their right and interest therein, the exclusive license to exploit, manufacture and sell in any part of the world a patent for lamps for electric lighting, registered as "Arc Lamp" in Belgium, and to carry on in France and elsewhere the business of dealers in electric lamps, carbons and accessories, &c. The subscribers (with 350 shares each) are:—W. D. Hendry, 49, Virginia Street, Glasgow, accountant; J. Robertson, 45, Hope Street, Glasgow, machinery agent. The number of directors is not to be less than three or more than five: The first are W. D. Hendry, J. Robertson and W. F. Fellows. Registered office, 49, Virginia Street, Glasgow.

Egham and District Electric Light Co., Ltd. (99,625).—This company was registered on September 23rd, with a capital of £25,000 in £5 shares, to acquire the business carried on at Egham as the "Egham Electric Lighting Syndicate," and to take over among the assets thereof the benefit of a certain provisional order. The subscribers (with one share each) are:—F. S. Powell, The Elms, Egham, diamond merchant; F. J. Powell, 17, Poland Street, W., lapidary; G. Gray, Westwood, Egham Hill, builder; T. H. Martin, 3, Pall Mall East, S.W., surveyor; W. H. Gardiner, 155, High Street, Egham, landowner; E. C. L. Baker, Church Street, Staines, builder; J. Goring, jun., Ironbarks, Staines, butcher. Minimum cash subscription, £5; the first directors are F. S. Powell and F. J. Powell. Table "A" mainly applies. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Kidderminster and District Electric Lighting and Traction Co., Ltd. (59,972).—This company's annual return was filed on August 21st, when 4,700 ordinary and 3,000 preference shares had been taken up out of a nominal capital of £100,000 in £10 shares (5,000 preference). £77,000 has been received. Mortgages and charges: £27,500.

New General Traction Co., Ltd. (47,321).—This company's annual return was filed on July 20th, when the entire capital of £370,000, in 50,000 preference and 24,000 ordinary shares of £5 each had been taken up. £5 per share has been called up on the preference, and £250,000 has been received. £120,000 is considered as paid on the ordinary. Mortgages and charges: £325,700.

Edmundson's Electricity Corporation, Ltd. (52,013).—Trust deed dated August 15th, 1908, to secure £100,000 debenture stock, has been registered. Property charged: £76,900 first mortgage debentures, and £5,800 first mortgage debenture stock in various subsidiary undertakings and the company's other assets, present and future. Trustees: Electric and General Investment Co., Ltd., 1-2, Great Winchester Street, E.C. Trust deed dated August 13th, 1908, securing an additional ½ per cent. per annum, and in certain events a premium of 5 per cent. in respect of £472,000 the amount now outstanding of an issue of £480,000 first mortgage debenture stock secured by trust deeds dated July 10th, 1899, and December 29th, 1903, and seven indentures dated April 27th, 1900, to January 19th, 1906, has been registered. (The deed of August 13th, 1908, is supplemental to the deeds of 1899 and 1903 and indentures of 1900 to 1906.) Trustees: Sir James Bailey, Eaton Square, S.W.; and Anglo-American Debenture Corporation, Ltd., 20, Birchin Lane, E.C.

Brush Electrical Engineering Co., Ltd. (29,533).—A trust deed dated September 4th, 1908, to secure £125,000 prior lien debenture stock, has been registered. Property charged: Certain freehold and leasehold property in Loughborough, Leicestershire, and the company's other assets, present and future, including uncalled capital. Trustees: Electric and General Investment Co., Ltd., 1, Great Winchester Street, E.C.

Morley Electrical Engineering Co., Ltd. (52,358).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Amount, £3,000 (no particulars).

Madeira Electric Lighting Co., Ltd. (44,371).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Debentures dated 1896 and 1897, securing £15,000.

Electric Construction Co., Ltd. (39,292).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Trust deeds dated 1897 and 1899, securing £200,000 and £50,000 respectively.

Veritys, Ltd. (49,784).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgages dated dated 1896 to 1901, securing £11,200.

Davey, Paxman & Co., Ltd. (57,093).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Trust deed dated 1898, securing £98,300 first mortgage debenture stock.

Lisbon Electric Tramways, Ltd. (62,983).—Particulars of £500,000 debentures, created by resolution of November 5th, and secured by a trust deed dated November 22nd, 1899, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £90,000. Property charged: Lease of tramways in Lisbon and the company's undertaking and property, present and future. Trustees: L. Breitmeyer and C. Rube.

Buda Electric Supply Co., Ltd. (95,137).—Particulars of £2,500 debentures created by resolution of April 14th, 1908, have been filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the amount of the present issue being £700. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Bristol Tramways and Carriage Co., Ltd. (25,088c).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: First mortgage debentures dated 1888 to 1899, securing £100,000.

Electric Equipment and Securities, Ltd. (London).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date, and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgage or charge dated 1905, securing £3,000.

Switchgear Co., Ltd. (85,405).—Amended return *re* second debenture dated July 7th, 1908, securing £2,000, has been registered. Original return gave address of holders (Cowans, Ltd.), as 4, Queen Victoria Street, E.C., instead of Victoria Works, Wilfred Street, Salford, Manchester.

W. T. Glover & Co., Ltd. (56,124).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date, and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1900. Particulars: Debentures dated 1899, securing £60,000.

Pontypool Electric Light and Power Co., Ltd. (36,109).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date, and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgage or charge dated 1898, securing £5,000.

CITY NOTES.

Willans & Robinson, Ltd.

The accounts for the half-year ended June 30th, 1908, show that as regards Rugby, after writing off £6,511 as depreciation, there is a profit of £18,473, as the result of the half-year's work. As regards Queen's Ferry, there is a net loss on the half-year's working (after contributing to debenture interest and to the directors' salaries) of £2,786. The net profit for the half-year is therefore £15,687, and the total amount available for distribution or otherwise, including £7,443, brought forward from last half-year, is £23,130. The directors propose to pay a dividend at the rate of 6 per cent. per annum upon the preference shares, absorbing £9,999 18s.; to apply £1,750 partly in paying interest upon, and partly in redeeming

funding certificates, in accordance with the approved scheme; and to pay a dividend at the rate of 10 per cent. per annum upon the ordinary shares, amounting to £3,333. A balance of £8,047 remains to be carried forward. The profit for the half-year, though inferior to that for the half-year preceding, is approximately the same as for the corresponding period of 1907. Allowing for the fact that the first half of the year is rarely so good as the second half, it will be seen that the company maintains its position, and as the earnings are more than sufficient to pay the usual dividend, and as there is a considerable balance to be carried forward, the directors do not think it necessary to propose any change. But in view of the present exceedingly unfavourable trade outlook, they think it right to point out that, unless there should be a definite revival of business, it will not be safe to assume that the recent satisfactory progress of the company will be sufficiently maintained to assure the continuance of the present dividend upon the ordinary shares. The Queen's Ferry Works were offered by auction on September 16th, but were not sold. No exertion will be spared to effect a sale by private treaty, and in any case it is intended to dispose of that portion of the plant which it is not specially desired to retain with the buildings. Work at Queen's Ferry has practically ceased.

Electric Power on the Witwatersrand.

An application has been made to the Committee of the Berlin Stock Exchange for sanction to the admission in that market of 5 per cent. bonds of the Victoria Falls Power Co. to the extent of £800,000, the bonds being of the bearer type and redeemable at 110 per cent. commencing in January, 1917. The application is accompanied by a statement announcing that after providing for depreciation the net profits realised in the past year from the working of the two old stations which were taken over on the formation of the company already exceeded by over one half the amount necessary for the payment of interest on the bonds. As to the two new stations, the first of 8,000 H.P. erected at Brakpan started the supply of current in September, and the second, which will be of 16,000 H.P., is expected to be completed at Simmerpan in the first half of 1907. The two old stations have hitherto been loaded beyond the normal capacity, and remunerative employment for the Brakpan station has already been assured. Although the company borrowed its title from the Victoria Falls, it is mentioned that the transmission of power thence to the Rand will only be thought of when the remunerativeness of such a project has been proved. The orders given by the company to the Allgemeine Electricity Co. at present exceed not inconsiderably the amount of the bonds taken over by the financial syndicate associated with the latter undertaking. This amount was £625,000, whilst the balance of £175,000 was given in payment to the parties interested in the Rand Central Electric Works, including the Goerz group. The admission of the total of £800,000 to the Berlin Exchange will be followed by an invitation for subscriptions to bonds totalling £625,000, or the exact amount taken over by the Allgemeine group.

Dick, Kerr & Co., Ltd.

The ordinary general meeting of this company was held on Tuesday at the Cannon Street Hotel, under the chairmanship of Mr. John Kerr.

The Chairman, in moving the adoption of the report (see Electrical Review, page 509), said it was with regret that they had to announce on the year's working a decrease in the profits which they had obtained in previous years. This reduction had not arisen from any slackness on the part of the board, or restriction in the efforts of a very energetic and capable staff, but was entirely owing to the very severe competition met with in every department of their business. If they would refer to the reports for the previous two years, they would see that they made strong reference to this acute competition, but during the year now under review it had been accentuated. In addition to severe trading competition, the financial crisis in America had had its effect all over the world, and they, among others, had suffered very considerably, inasmuch as investors hesitated to enter into new enterprises. This, of course, seriously affected a business like theirs. Again, owing to the financial crisis, as well as the high Bank Rate, municipal borrowing had been considerably restricted, and as they were largely dependent upon the municipalities for one particular branch of their business, this had had a serious effect upon the turnover. The electrical industry had been engaged in a very severe struggle for some years past, and he was sorry to say that at the moment, at all events, he could not see that there was much likelihood of competition becoming less keen in this country. They were, therefore, devoting most of their energies to developing Colonial and foreign business, and he was sure it would be of interest for them to know that a very large proportion of the machinery now manufactured in their Preston works was for abroad. As an instance of how they were obtaining a foothold in new markets abroad, he might mention that they had taken a rather important contract for tramway car equipments for the City of Moscow, and this in the face of very keen competition from Continental makers. In South America and Japan particularly, their business connection had been increasing rapidly, and he was hopeful that when the financial situation improved they would be successful in securing some large contracts, and he trusted at better prices than were at present ruling. They were doubtless aware that the extraordinary demand which existed a few years ago for electric tramway equipments had been steadily falling off, owing to most of the lines at home and abroad being now electrified. They had, therefore, deemed it necessary to devote some attention to another and important branch of the business which hitherto they had not developed. He referred more particularly to important power schemes, both hydraulic and steam. This class of business had been very largely exploited in Switzerland, Norway, America, and Canada, and their plant at Preston being designed specially to deal with heavy machinery, they were utilising it in this direction as opportunity offered. Their directors had never been guilty of holding too sanguine views; however, if they had found it possible to complete this year under review with £59,558 of profit, it was not too much to expect that within a reasonable period a prosperous time would return. In the past they had adopted a policy of building up strong reserves, and the present carrying forward of £81,567 of undivided profits must meet with the approval of the shareholders, in view of the fact that the works had been maintained in the highest state of efficiency, and that the plant and machinery had been amply depreciated. One constantly heard the cry of "support home industries," and bearing on this, if he might make a respectful suggestion to their financial friends in the City, it would be to ask their good influence on behalf of English manufacturers, on those occasions when they found the capital for enterprises abroad. It did seem hard to know of money leaving London by millions, which eventually had the effect of securing employment for factories in Germany and America. Financial houses knew their own business best, but a little patriotic feeling and support might do much in helping the cause both of the unemployed and industrial capital in their own country. He would like to express, on behalf of the board, their high appreciation of the management and staff throughout a trying year's business. Regarding the figures in the accounts, they practically reflected the trading position for the year.

Mr. Claud T. Cayley seconded the motion.

Mr. Concannon complimented the board on their remarkable modesty, seeing that they had maintained their dividend in the face of terrible competition. It was notorious that kindred companies, working under as good if not better conditions than Dick, Kerr & Co., had had disastrous results. With regard to the chairman's appeal to City financiers, he could say that they fully recognised the superiority of the work of the company, and it was not due to any lack of goodwill on their part that they did not help home enterprises, but owing to the fact that for the time being the investing public had more confidence in the industries of other countries.

The report was adopted.

The retiring directors and auditors were re-elected, and a hearty vote of thanks was passed to the chairman, the board, and the staff.

The Chairman, in reply, said the company did not mind a hard fight for business, but they wanted a fair fight.

Prospectuses.—*The Railway Audible Signal Co., Ltd.*—The list was to close on Wednesday in an issue of 14,793 shares of £1 each in this company, which has been formed to acquire certain inventions relating to signalling on railways. The company's system has been at work on the Great Western Railway branch line between Yarnton Junction and Fairford (21½ miles single-line track) since December, 1906, and on some other lines of the same railway. The subject of the inventions is an apparatus by which a signalman is enabled to communicate direct to the cab of an engine "All right" or "Danger" signals, the "All right" signal being indicated by the sounding of an electric bell, and the "Danger" signal by the sounding of a special steam whistle; and whichever signal is given, the sound continues until it is acknowledged by the driver stopping it. The vendors are the Western Syndicate, Ltd.

Glendon Rubber Co., Ltd.—The list was to close yesterday in an issue of £52,000 shares of £1 each in this company, which is to purchase and work the Glendon, Rogart and Langsland Estates, situated in the Kalutara District, in Ceylon.

Western Union Telegraph Co.—The reports presented to the auditors show that while business is not what it was, it has improved over recent months, says the *Telegraph Age*. The company, it continues, was never in a better condition than at present, and its employés are more satisfied. Earnings of the company for the September quarter, estimated in part, show marked improvement over the actual figures for the same time last year and in 1906, the net revenue amounting to $1,700,000, compared with a deficit of $311,493 in 1907, and its surplus, after charges and interest, amounting to $769,149, compared with a deficit of $1,961,580 at the same time a year ago. The actual returns for June quarter show a surplus of $649,052, against a deficit in the June quarter last year of $68,324.

Bergmann Electricity Co.—The *Financial News* Berlin correspondent says that the directors of the above company will shortly put before shareholders a proposal for the increase of the company's capital from M. 14,000,000 to M. 21,000,000 by the issue of M. 7,000,000 of new shares, which will be offered to present holders at the price of 165 per cent.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors announce a dividend on the preference shares at the rate of 6 per cent. per annum for the six months ending 30th ult.

MARKET QUOTATIONS.

Wednesday, September 30th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	38/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£63 10	..
a ,, ,, ...	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£16	..
a Copper Sulphate	per ton	£21	..
a Lead, Nitrate	per ton	£25	£2 dec.
a ,, White Sugar..	per ton	£23 10	10/- dec.
a ,, Peroxide	per ton	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium Bichromate, in casks	per lb.	5½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	per b.	9d.	..
a Potassium Cyanide	per lb.	7d.	..
a Shellac	per cwt.	100/-	15/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	6d.	..
a ,, Cyanide (basis 100 %) ..	per lb.	1d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£80	..
b ,, Wire, in ton lots ..	per ton	£130	..
b ,, Sheet, in ton lots ..	per ton	£128	..
c Babbitt's metal ingots	per ton	£50 to £130	..
c Brass (rolled metal 2" to 12") basis	per lb.	7⅝d.	⅛d. dec.
c ,, Tube (brazed)	per lb.	8¼d.	¼d. dec.
c ,, ,, (solid drawn).. ..	per lb.	7⅝d.	¼d. dec.
c ,, Wire, basis	per lb.	6⅝d.	⅛d. dec.
c Copper Tubes (brazed)	per lb.	9½d.	⅛d. dec.
c ,, ,, (solid drawn) ..	per lb.	9½d.	⅛d. dec.
g Copper Bars (best selected) ..	per ton	£78	£2 dec.
g Copper Sheet	per ton	£78	£2 dec.
g ,, Rod	per ton	£78	£2 dec.
c ,, (Electrolytic) Bars ..	per ton	£68 10	10/- dec.
c ,, ,, Sheets ..	per ton	£79 10	10/- dec.
c ,, ,, Rod ..	per ton	£68 10	10/- dec.
c ,, ,, H.C. Wire	per lb.	8¼d.	⅛d. dec.
f Ebonite Rod	per lb.	3/3	..
f ,, Sheet	per lb	3/-	..
m German Silver Wire	per lb.	1/6	..
h Gutta-percha, fine	per lb.	5/6 to 6/6	..
h India-rubber, Para fine	per lb.	4/3	1d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	51/3	5½d. dec.
l ,, Wire, galv. No. 8, P.O.qual.	per ton	£14	..
g Lead, English Ingot	per ton	£13 7 6 to £13 12 6	..
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 5	..
d Mica (in original cases) small ..	per lb.	6d. to 1/-	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large ..	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/- to 1/1½	..
p ,, rolled bars & rods	per lb.	1/2 to 1/3	..
p ,, ,, strip & sheet	per lb.	1/2½ to 1/5	..
o Platinum	per oz.	85/- to 90/-	..
e Silicium Bronze Wire	per lb.	9½d.	½d. dec.
r Steel, Magnet, in bars	per ton	£50	£5 dec.
g Tin, Block (English)	per ton	£131 10 to £132 10	£2 inc.
n ,, Wire, Nos. 1 to 18	per lb.	1/9	..
p White Anti-friction Metals—			
"White Ant" brand	per ton	£34 to £53	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£24 5	..

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Stock Exchange Notice.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—Havana Electric Railway Co., $1,115,000 additional consolidated mortgage 5 per cent. 50-year coupon bonds, 1952, for $1,000 each, Nos. 6,958 to 8,072.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended August 28th, 1908, were 615,469, compared with 564,913 units in the corresponding four weeks of 1907.

Hove Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares of the company at the rate of 8 per cent. per annum for the six months ended June 30th last. The dividend will be payable on October 15th next.

STOCKS AND SHARES.

Tuesday Afternoon.

Stock Exchange business continues to give indications of awakening activity. Foreign politics, as a factor in high finance, are somewhat disquieting, but the markets as a whole pay more regard to domestic matters than to Morocco, Turkey, or Bulgaria. Amongst the main items of interest this week, is another spurt in Home Railway stock, for reasons resting for their main support upon the impression that prices have been unduly deflated, and that revival is justified by the outlook.

In this improvement the Tube railway stocks mostly participated. Central London Ordinary and Deferred are creeping up again, the company's traffic record being decidedly satisfactory. Of course it is true enough that the present season is likely to prove exceptional, but on the other hand, the additional receipts should prove very useful in the way of placing the company in a strong financial position. The 4 per cent. Debenture stock looks cheap at about 103, but it has to be remembered that the security has no Preference issue behind it. District Debenture stocks have had a brisk rise this week.

Metropolitan Consolidated stock rose 2 to 39½, and District Ordinary regained its loss at 13½. The market is rather short of "Mets.," and there was an idea current on Monday that the beer show of the preceding day in Hyde Park would materially assist the week's takings. It is a little surprising to some people that proprietors of the Great Northern and City Railway do not agitate for steps to be taken which shall, at all events, attempt to cope with the present unfortunate conditions beneath which the undertaking labours. Underground Electric notes are rather better.

Of the electrical traction issues, British Electric Ordinary and Preference have again been marked down, and the First Debenture stock at 97½ is ½ lower. Westinghouse Debenture shed a point; Mexico Tramways Common stock rose 3 to 126½, while the bonds at 92½ are a fraction easier. Rio shares gained 1½ at 67½, the bonds being unchanged at 90½. Sao Paulo Ordinary is 157, the bonds 99¾.

Mexican Light and Power Common stock put on 4 at 81, although the Preference at 112½ went down a little. The bonds are firm at 92. Shawinigan bonds at 104 keep steady, and Canadian Generals are 106 and 116 for Ordinary and Preferred respectively. Mexico Electric Light bonds at 90½ are better.

Authoritative opinion in the market takes the view that the rise in these lighting, power and tramway issues has, on merits, gone as far as it is justified by conditions which prevail at the present time. Nevertheless, due recognition is accorded to the obvious truism that speculation may take prices still higher, and the 5 per cent. bonds of these companies, such as those which stand between 90 and 95, offer very fair mediums for investment, both as regards reasonable security and the prospect for appreciation in value. Naturally, the buyer of a 5 per cent. bond at, say, 92, faces a certain risk which he must be prepared to take if he wants 5¼ to 5½ per cent. on his investment.

Electricity Supply shares present a line of steadiness. There are rises of 5s. each in Brompton Ordinary and Preference, and Westminster Ordinary. Bromley Debenture has been in some request. London Electric Supply Preference are easier: so are South London Ordinary shares.

Electric Constructions receded 2s. 6d. after their 5s. rise. Amongst the manufacturing division, Dick, Kerr lost a trifle upon the reduction in the profits, but the Willans & Robinson report, out this week, proved to be unexpectedly good, causing a rise to £3 in the £5 fully-paid Preference. At this price the return is 10 per cent. on the money, and the shares look more attractive than the Ordinary, which stand at their par price of a pound.

Apart from the gambling in Anglo-American Deferred stock, the Telegraph and Telephone catalogue remains singularly quiet. Anglo "A" has risen substantially in sympathy with the violent fluctuations in American rails. The company has this week vacated its offices at the apex of Throgmorton Street and Old Broad Street, and the building is to be pulled down to make way for a more imposing structure. Great Northern Telegraph shares are 30s. better.

A fall of 5s. in National Telephone Second Preference places the price of these shares again in line with that of the First Preference. The company's Preferred stock is ½ better at 110. American Telephone and Telegraph varieties have recovered, and other Telephone descriptions are all firm. Henley's Ordinary at 11 show a 5s. rise.

Brisbane Electric Tramways Investment Co., Ltd.—The directors have decided on the payment of the following interim dividends on November 2nd in respect of the profits for the half-year to June 30th, 1908:—The usual half-yearly dividend of 2s. 6d. per share on the preference shares; a dividend of 2s. 6d. per share, free of income-tax, on the ordinary shares.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Sept. 22nd.	Closing Quotations Sept. 29th.	Business done week ended Sept. 29th, 1908. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2 — 3	2 — 3	..	..	..	Nil.
143,800	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6
$131,551,400	American Telephone & Telegraph, Cap. Stock	$100	7½%	7½%	8 %	8 %	129 —133	131 —135	..	..	+2	5 18 6
53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	92 — 94	93 — 95	..	..	+1	4 4 3
598,180	Anglo-American Telegraph	Stock	2⅜%	3½%	3⅞%	3¼%	58 — 61	58 — 61	59⅜	..	..	5 14 9
3,200,910	Do. do. do. 6 % Pref.	Stock	5⅜%	6 %	6 %	6 %	103½—104½	103½—104½	104⅜	103½	..	5 14 10
3,200,910	Do. do. do. Deferred	Stock	Nil	½	1⅜%	1 %	16⅜— 16¾	17⅛ — 18	18 7/16	16 1/16	+1⅛	5 11 1
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	5 %	99 —102	99 —102	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8½	8 — 8½	8 1/16	..	..	4 14 1
2,383,376	Commercial Cable Stng. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	89 — 91	89 — 91	90½	89½	..	4 7 1
16,000	Cuba Telegraph	10	5 %	5 %	5 %	6 %	7⅛ — 8¼	7⅛ — 8¼	8	..	..	7 1 2
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	15½ — 16½	16 — 17	..	..	+ ½	5 17 8
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	6 3 1
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %	8 — 9	8½ — 9½	..	..	+ ½	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	8 14 10
60,710	Direct United States Cable	20	3½%	4½%	4½%	4½%	13½—13⅝	13½— 13⅝	13⅝	13⅜	..	6 3 8
50,900	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	135½—138½	135½—138½	137½	135⅞	..	5 8 4
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	84½— 86½	84½— 86½	85⅝	84½	..	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red.	Stock	4 %	4 %	4 %	4 %	103 —105	103 —106	103½	..	..	3 16 2
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12⅜— 13½	12⅜— 13½	13	12⅜	..	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101½—103½	101 —103	..	..	— ½	3 17 8
269,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..	3 18 10
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	101½—103½	101½—103½	102½	..	..	3 17 4
181,127	Globe Telegraph and Trust	10	5⅝%	5½%	5½%	5½%	10⅝— 11¼	10⅝— 11⅜	11	10⅜	..	5 5 8
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13⅝— 14¼	13⅝— 14⅜	13⅝	13⅜	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen	10	24 %	24%	20 %	20 %	28½— 30½	30 — 32	29¾	29½	+1½	6 5 0
19,600	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13⅜	13 %	13 %	13 %	56 — 59	56 — 59	57	..	..	6 7 1
$41,380,400	Mackay Companies Common	$100	1⅜	2 %	3½%	4 %	68 — 72	68 — 72	68½	..	..	5 9 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 9 7
884,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜ — ½	⅜ — ½	8/6	7/9	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	1 — 1⅛	1 — 1⅛	21/3	18/9	..	5 6 8
86,492	Do. do. do. 5 % Pref.	1	5 %	6 %	5 %	5 %	⅞ — 1	⅞ — 1	..	..	..	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	103½—110½	109 —111	110	109½	+ ½	5 8 1
3,725,000	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	118 —120	118 —120	118⅞	118½	..	5 0 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 11¼	10½ — 11¼	10⅜	..	..	5 6 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	5 %	5 %	10½ — 11½	10½ — 11½	..	..	— ½	4 8 11
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅝ — 5 11/16	5⅝ — 5 11/16	5 13/16	5 25/32	..	4 9 11
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	3½%	98½—100½	98½—100½	..	..	..	3 7 8
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	102½—104½	102 —104	102	..	— ½	3 16 11
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6¼%	7 %	7 %	8 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	5 16 4
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	4 11 5
99,100	Do. do. do. 4 % Red. Deb. Stock	100	..	4 %	4 %	4 %	89 — 92	89 — 92	..	..	..	4 7 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
11,889	Reuter's	8	5 %	5 %	5 %	5 %	7⅛ — 8¼	7⅛ — 8¼	..	..	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 10 11
100,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅝ — 7¼	6⅞ — 7¼	6¾	..	..	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4⅝ — 4¾	4⅝ — 4¾	..	..	..	5 2 7
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	2½%	1 5/16 — 1 7/16	1¼ — 1⅜	..	..	+ 1/16	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	7 %	7 %	13⅜— 14½	13⅜— 14½	13⅞	13⅜	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	101½—103½	101½—103½	..	..	..	3 17 4
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	6 %	8 — 8½	8 — 8½	..	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	£2 6	8¼ — 9½	8¼ — 9½	..	..	..	2 9 0
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

890,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	8 %	9 %	8 11/16 — 8 15/16	8 11/16 — 8 15/16	8 13/16	..	..	5 0 8
260,007	Do. 6 % Cum. Prefs., 1 to 260,007	5	5⅜%	5½%	5⅝%	5⅞%	6 3/16 — 6 5/16	6 3/16 — 6 5/16	6 5/16	..	..	4 11 2
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	143 —148	143 —148	..	..	..	4 6 11
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock	100	5 %	5 %	5 %	5 %	103 —106	103 —106	104½	..	..	4 14 4
530,000	Babcock & Wilcox, 1 to 530,000	1	20 %	20 %	20 %	20 %	8 3/16 — 4 1/16	8 1/16 — 4 1/16	..	..	..	4 18 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	5 13 10
40,000	British Aluminium, Ord., 1 to 40,000	1	7 %	7 %	7 %	7 %	2 3/16 — 2 5/16	2 3/16 — 2 5/16	51/3	..	..	12 3 6
40,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	3 3/16 — 4 1/16	3 3/16 — 4 1/16	77/6	75/7½	..	8 9 8
40,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	4 1/16 — 4 3/16	4 1/16 — 4 3/16	..	..	..	6 6 4
20,000	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3 15/16 — 4 1/16	3 15/16 — 4 1/16	..	..	..	4 14 1
20,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	106 —110	106 —110	..	..	..	4 10 11
238,200	Do. do. 5⅛ % Loch Leven Debs.	100	..	..	5⅛%	5⅛%	97 —100	97 —100	..	..	..	5 10 0
300,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	8 %	136 —140	136 —140	..	..	..	5 14 4
400,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	117 —121	117 —121	120	118	..	4 2 8
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	105 —109	105 —109	107½	..	..	4 11 9
300,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	101 —104	102 —104	..	..	+ ½	4 6 7
233,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100½—103½	100½—103½	..	..	..	4 7 0
220,000	British Electric Traction	10	6 %	3 %	Nil	Nil	1 — 1⅜	⅞ — 1⅛	22/6	17/6	— 3/16	Nil
133,801	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	3 %	3/32 — 4⅛	3¼ — 4⅛	77/6	75/-	— ⅛	7 1 2
161,497	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	5 %	96½ — 99½	96 — 99	104½	98	— ½	5 1 0
1,473,653	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	76 — 78	76 — 78	..	..	..	5 16 5
528,936	British Insulated and Helsby Cables	5	8 %	8 %	10 %	10 %	6¼ — 6⅝	6¼ — 6⅝	..	..	..	7 8 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	8 %	6 %	6 — 6⅜	6 — 6⅜	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
212,000	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅛ — ⅜	5/16 — 3/8	..	..	+ 3/16	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	41 — 46	40 — 45	43½	..	— 1	8 17 10
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	1	Nil	2½%	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	68 — 73	68 — 73	..	..	..	6 3 3
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	50 — 54	50 — 54	..	..	..	8 6
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	8 %	8 %	5⅛ — 6	5⅛ — 6	5⅜	5 5/16	..	5 0 0
80,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	..	6 %	5 %	5 %	4¼ — 5¼	4¼ — 5¼	98/9	..	..	4 15 8
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	102 —105	103 —106	104½	..	+1	4 4 11
85,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	15 %	9⅜ — 10⅜	9⅜ — 10⅜	10⅜	9⅜	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	5 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	107⅛—109⅛	107⅛—109⅛	..	..	..	4 2 2
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	12 %	1⅜ — 1 15/16	1⅜ — 1 15/16	32/9	32/6	..	7 14 10
215,045	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	106 —107	108 —107	..	..	..	4 4 1
1,893,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	3 %	68 — 70	68 — 70	70	68½	..	4 6 11
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	85 — 87	..	..	+ 1	4 12 0
553,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	49 — 52	50 — 53	52½	51½	+ 1	3 15 6
1,490,000	City and South London Railway	Stock	2½%	1¾%	2½%	2½%	32½ — 33½	32½ — 33½	33½	32	..	6 6 10

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Sept. 22nd.	Closing Quotations Sept. 29th.	Business done week ended Sept. 29th, 1908. Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
		*										£ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	2½%	5 %	5 %	1⅝ — 1⅞	1⅝ — 1⅞	..	..	..	9 10 6
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	98 —101	98 —101	99½	..	..	4 19 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1½ — 1⅝	1⅝ — 1⅞	26/3	25/6	— ⅛	6 19 2
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1⅞ — 1⅞	1 — 1⅛	23/-	22/6	— ⅛	4 16 0
282,580	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	101 —104	..	..	+1	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6¼%	11½ — 12½	11⅝ — 12⅝	..	..	..	5 4 0
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½%	4½%	4½%	4½%	⅞ — 1	⅞ — 1	..	..	..	16 12 6
17,189	Do. "A" shares, 01—017,189	5	2½%	4½%	4½%	4½%	1 — 2⅛	1⅛ — 2⅛	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	76 — 79	76 — 79	..	..	..	5 1 8
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	85 — 87	85 — 87	..	..	..	5 14 11
112,100	Electric Construction, 1 to 112,100	2	4 %	Nil	Nil	Nil	⅜ — ⅞	⅜ — ⅞	..	..	— ⅛	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7½ — 8	7½ — 8	..	..	..	6 5 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	86 — 90	86 — 90	..	..	..	4 8 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	4 %	¾ — 1	¾ — 1	..	..	..	5 0 0
95,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10	10½ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103	..	..	..	4 17 1
40,000	Henley's (W. T.), Telegraph Works, Ord.	£5	15 %	15%	15 %	15%	10½ — 11½	10½ — 11½	..	..	+ ½	7 8 2
40,000	Do. do. 4½ % Pref.	£5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5½	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107 — 109	..	..	..	4 2 7
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	5 %	10%	10 %	10 %	15½ — 16½	16 — 17	16½	..	+ ½	6 11 2
57,500	†Liverpool Overhead Railway, Ord.	10	1½%	Nil	Nil	½%	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 0 0
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	9 1 10
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	6 %	8 %	8½%	6⅜ — 6⅝	6⅜ — 6⅝	..	..	..	4 8 11
899,980	Do. do. 60,008 to 100,000	10	6 %	8 %	8 %	8 %	6⅜ — 6⅝	6⅜ — 6⅝	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	6 %	6 %	5 %	5⅛ — 6⅛	5⅛ — 6⅛	5⅜	5⅛	..	8 0 0
1,581,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	75 — 80	75 — 80	75	..	..	5 0 0
5,782,062	Metropolitan Consolidated	100	3 %	2⅜%	1 %	¾%	37 — 38	39½ — 40½	40⅜	37⅜	+2½	1 4 6
2,640,914	Do. Surplus Lands	100	2¾%	2⅜%	2¾%	2¾%	66 — 68	66 — 68	67½	66½	..	4 0 11
8,285,000	Do. District	100	Nil	Nil	Nil	Nil	12½ — 13½	14 — 15	14⅜	13⅜	+1½	Nil
314,016	Metropolitan Electric Trams., Debs.	1	Nil	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅜ — ⅝	⅜ — ⅝	16/-	..	..	6 13 4
350,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	92 — 95	92 — 95	94½	..	..	4 14 9
245,500	Potteries E. Tre.	1	5 %	4 %	4 %	4 %	¼ — ⅜	¼ — ⅜	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅜ — ⅝	⅜ — ⅝	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	92 — 95	92 — 95	..	..	..	4 14 9
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	32 — 34	32 — 34	33½	32	..	6 18 8
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	5 %	5 %	5 %	5 %	42 — 46	43 — 47	..	..	+1	10 12 0
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	Nil	10 %	⅜ — 1½	⅜ — 1½	20/-	..	..	3 0 1
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	Nil	Nil	..	6 %	2½ — 3	2½ — 3½	57/6	..	+ ½	9 4 7
46,404	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	72 — 76	72 — 76	..	..	..	5 5 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	0	0%	0%	0%	0%	⅛ — 0	⅛ — 0	..	..	..	0 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	96 — 99	96 —100	..	..	+ ½	4 10 0
30,181	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10%	10 %	6⅞ — 7⅞	7 — 8	..	..	+ ¼	6 5 0
9,869	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6⅞ — 7⅞	7 — 8	..	..	+ ¼	4 7 6
386,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	99 — 102	7⅞	7½	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	8 %	5 %	5 %	5 %	3½ — 4	3½ — 4	72/6	71/3	..	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4½	4 — 4½	..	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3½ — 4	3½ — 4	7⅞	..	..	5 12 6
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 10 11
49,486	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	4½%	2⅜ — 3½	2⅜ — 3½	57/6	..	..	6 8 7
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	9½ — 10½	9½ — 10½	9⅝	..	..	5 17 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	12⅜	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 —125	122 —125	..	..	..	4 0 0
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
40,000	County of Durham Electrical Power, Ord.	£5	£3 7 0	4 %	4 %	2 %	2½ — 3	2½ — 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	£5	5 %	5 %	5 %	5 %	3⅞ — 4½	3⅞ — 4½	..	..	..	5 17 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	7½ — 8½	7⅞ — 8⅝	..	..	..	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 10⅝	10⅜ — 10⅝	..	..	..	5 10 4
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
80,000	Edmundson's Electricity Corporation, Ord. Shares	5	7 %	4 %	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	8 %	Nil	¾ — 1	¾ — 1	15/6	15/-	..	Nil
488,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	59 — 66	59 — 66	..	..	..	15 4
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	..	..	84½ — 87½	86½	85⅝	..	..
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 — 100	97 —100	..	..	..	4 10 11
15,000	Hove, 1 to 15,000	5	8½%	9 %	9 %	8½%	6 — 6¼	6 — 6¼	..	..	..	6 10 9
$1,325,000	Kaministaquia Power Co., 5 % Gold Bnds.	..	..	..	..	..	..	94 — 96	95	94½	..	..
21,000	Kensington and Knightsbridge Electric Ord.	5	12 %	10 %	10 %	10 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	5 14 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
10,000	London Electric Supply Corporation, Limited, Ord.	3	8 %	4 %	4 %	2½%	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 8 1
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅛ — 4⅜	4⅛ — 4⅜	..	..	— ⅛	6 9 9
74,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	89 — 92	89 — 92	..	..	..	4 17 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10 %	8 %	6½%	4½ — 4⅝	4½ — 4⅝	..	..	..	6 16 10
76,121	Do. 4½ % Cum. Pref. 1—71,100	5	4½%	4½%	4½%	4½%	4½ — 5	4½ — 5	..	..	..	4 12 4
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —109	105 —109	..	..	..	4 2 7
250,000	Do. 5% Mort. Deben. Stock Redem.	Stock	5%	5%	5%	5%	84 — 89	84 — 89	..	..	..	5 18 8
$5,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	..	90 — 91	90½	..	..	5 9 11
$13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	..	..	80½ — 81½	80⅝	76	..	..
$1,500,000	Do. do. 7% Cum. Pref. Stk.	$100	..	..	..	..	..	112 —113	112½	..	..	..
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	..	..	91½ — 92½	92½	91⅜	..	..
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	8 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	7 19 2
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 6 11
10,852	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	11½ — 12½	11½ — 12½	..	..	..	5 17 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	5⅝ — 6⅛	5⅝ — 6⅛	..	..	..	5 14 3
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 99	..	..	..	4 1 8
119,691	River Plate Electy. Co. Ord. Nos. 1 to 120,507	1	..	..	2½%	..	..	1⅜ — 1⅝	..	..	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6	6	6	6	..	⅝ — 1⅛	..	..	..	..
194,684	Do. do. 5% Deb. Stk. Red.	100	5	5	5	..	..	99 —101	..	..	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	7 — 8	7 — 8	7⅞	7½	..	6 5 0
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6½ — 7½	6¾ — 7½	..	..	..	4 16 7
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3 %	3½%	3½%	86 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	4 %	2⅜ — 2⅝	2⅜ — 2⅝	..	..	— ⅛	7 5 5
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2½%	2½%	2½%	⅛ — ¼	⅛ — ¼	..	..	..	4 0 0
117,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	19/6	..	..	5 12 0
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	¾ — 1	¾ — 1	..	..	..	20 0 0
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1½ — 2⅜	1½ — 2⅜	46/3	45/-	..	10 10 6
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	..	..	..	5 5 11
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	..	⅜ — ½	..	..	..	..
110,000	Westminster Electric Supply, Ord.	5	14 %	13 %	12 %	10 %	7½ — 8½	7½ — 8½	8½	8	..	5 17 8
61,279	Do. do. 4½ % Cum. Pref. (Original) 5 %.—Red. to 4½ % from 31st Dec., 1903	5	5 %	5 %	4½%	4½%	5 — 5½	5 — 5½	..	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

Bank rate of Discount 2½ per cent., May 28th, 1908.

STEAM TRAPS.

By GORDON STEWART.

(*Concluded from page* 518.)

Dealing now with the traps of Class 2, *i.e.*, of the float and bucket type, this class of trap is exceedingly popular; for its principle possesses a very wide range of possible adaptations, and as far as simplicity, as regards both its construction and working, is concerned, it lends itself to a great variety of designs, the majority of which are very reliable in use. Briefly, they depend for their action upon the motion of a float, which automatically opens or closes a valve in accordance with the amount of water to be discharged.

The very simplest type of float trap consists of a box, containing a hollow ball float, so situated that when water is absent, a cone valve integral with the float is held by the steam pressure, combined with its own weight, against a discharge orifice in the base of the box; and when water is present the buoyancy of the float is relied upon to uncover this orifice, and permit a discharge.

Although possessing absolute simplicity, such a device has very narrow limits of possible application; the most important of which are undoubtedly the extremely small valve opening effort, combined with small discharge capacity. These two difficulties may be overcome by employing a large float, with a correspondingly larger box, but a practical limit is very soon reached in this direction. The method adopted by designers is mostly to increase the valve opening effort by arranging that the float effort is multiplied at the valve spindle by a system of levers, thereby keeping the size of the float within reasonable limits. An interesting illustration of this is shown in fig. 4, this being the method adopted in a trap known as the "Meulleur." In this case the force lifting the valve is about four times that exerted by the float. Another method of obtaining a multiplication of float effort is to attach the float to a rocking lever, the latter having a small conical valve on either side, the one opening outward and the other inward; by this means the valves are balanced for steam pressure, and therefore the system does not necessitate a large valve opening effort.

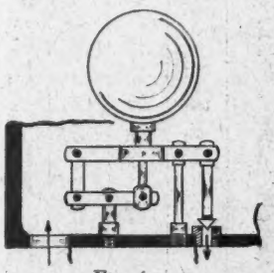

Fig. 4.

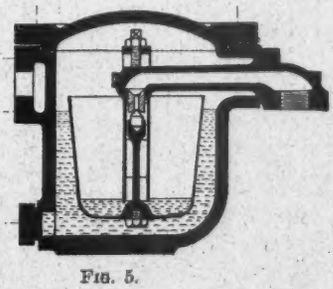

Fig. 5.

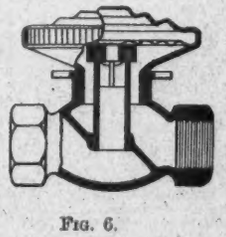

Fig. 6.

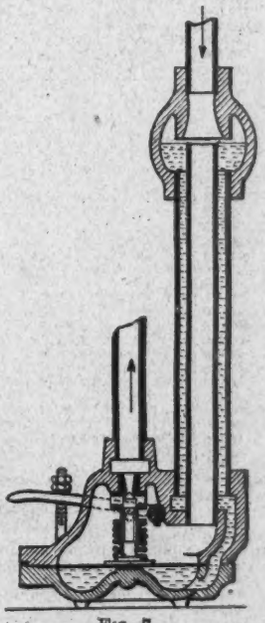

Fig. 7.

One of the best known types of float-operated traps is that manufactured by Messrs. Lancaster & Tonge, and known as the "Lancaster." It is a very reliable trap, and possesses great simplicity, there being only one working joint. The float is supported at one end by a hollow elbow pipe at the end of which is a hollow quick-threaded screwed spindle. The action of the float when rising is to cause this screwed spindle to close a valve leading to the drain, and when sinking to open this valve. With this brief description we will imagine that the float has sunk to the bottom of the trap, leaving the valve wide open. Water of condensation, having accumulated, will flow past the valve into the float, *viâ* the threaded spindle and elbow pipe. The float will remain in this position until the discharge is completed, when steam will appear; this latter on entering the float renders it buoyant, so that it rises and closes the valve. The steam imprisoned in the float will rapidly condense, draw water into the float, and again destroy its buoyancy, so that it sinks. Should a further accumulation of water be standing in the inlet pipe this will be discharged, but should live steam be present, the water will be driven out of the float, which will immediately rise, and the above operation will be repeated.

One disadvantage of float and bucket traps is that when not in use the box is about half full of water, which is very liable to freeze in cold weather, should the trap be in an exposed position. Other traps of the float type well worthy of note are the "Syphonia" of Messrs. Royles, and the "Emergency" and "Victor" traps of the Wright Manufacturing Co., of Detroit, U.S.A.

Bucket traps, as the name implies, depend for their working upon the action of a floating bucket, the motion of which is controlled by the amount of condensation. Of this class one well worthy of attention is the "Sentinel," by Messrs. Alley and MacLellan, of Glasgow (fig. 5). There are also several American traps of this class, chief among which I would mention the "Nason," the "Greenaway" and "Powers."

A very handy type of trap, and one capable of being designed so as to occupy a minimum of space, is the thermostatic type. They are usually employed in connection with steam heating systems; for, besides occupying very little space, they are comparatively cheap, so that a system of steam radiators may by their use be most efficiently drained without entailing a costly installation for the purpose. They usually consist of a flat corrugated chamber containing a very volatile spirit, and having a valve controlled by the motion of one side of this chamber. The position of the chamber relative to the valve is adjusted so that water of condensation may pass, but as soon as live steam impinges upon the corrugated chamber the volatile fluid rapidly expands and exerts an outward pressure on the walls, which are bulged out, shutting the valve by pressing it upon its seat. A section of a trap of this type is shown in fig. 6. There are numerous designs, differing only in some constructional feature calculated to produce better or more lasting results.

Another means of employing the thermostatic principle is that adopted by Messrs. Holden & Brooke, in their "Sirius" trap. In this design the volatile fluid is imprisoned in a Bourdon tube; the latter is anchored at one end and free to expand at the other, the free end controlling the valve. Another, and a more recent trap of this type, is that known as the "Twin tube."

A further adaptation of the thermostatic principle is exemplified by the "Horne" trap. In this trap the volatile fluid is contained in a cylindrical tube fitted with a piston at one end; the expansion of the fluid acting upon the piston operates a valve.

Class 4.—Differential water pressure traps. There is only one trap of this type of any note. It is the "Flinn," the invention of an American engineer, Mr. R. J. Flinn. There

is an originality about the design which cannot fail to attract attention. Briefly explained, the system consists essentially of two wrought-iron pipes of different diameters contained one within the other as seen in fig 7. These two pipes communicate at their lower end with a cast-iron chamber having two compartments separated by a flexible diaphragm, each compartment being in direct communication with one of the pipes. At the top end of the pipe is a specially shaped inlet leading to these two compartments, so that water of condensation entering here will first fill the lower compartment through the outer pipe, after which it will overflow into the inner pipe and fill the upper one. When there is the same head of water in both pipes there will be a pressure of equal intensity acting on both sides of the separating diaphragm. However, by the action of a light spring the upper side of this diaphragm is provided with an initial pressure, other than that obtained by the head; this spring being so adjusted that the pressures on the opposite sides of the diaphragm are equal when the inner tube is about half full, it is obvious that as soon as the water has mounted above half way the diaphragm will be deflected downwards by the pressure due to the increased head. The valve being controlled by the motion of the diaphragm, a discharge will take place whenever the water level in the inner tube is more than about half way up, but will not allow this level to fall below the point determined by the setting of the spring. This latter point is of more importance than is apparent at first sight, for by it absolute protection of the valve is ensured; nothing can pass but water, owing to the fact that before steam can appear the water level must fall to the bottom of the inner tube, which is a practical impossibility when the trap is in order. It will be recognised at once that the simplicity is attained by the employment of dynamic forces rather than of those due to temperature changes, &c., hence this type of trap is not affected by changes of steam pressure.

In a large steam installation the amount of condensation, together with its large store of sensible heat, is of no small consideration, and if this is allowed to pass away to the drain it represents a very appreciable annual loss, showing up, of course, in the coal bill. If, however, by some means or other, this condensation, instead of going to waste, is returned to the boiler as feed water, a great saving, not only of water and heat units, but in the general upkeep of the boiler, will result, for water of condensation, being distilled, does not carry injurious chemical matter likely to fur the boiler or produce other ill effects. Messrs. William Whiteley, of Huddersfield, are the pioneers of the return-feed system on this side of the Atlantic. In conjunction with a special design of steam trap, their system returns into the boiler, automatically and continuously, the condensation from a steam-pipe system. Briefly, their system is as follows:—

Every draining pocket or separator is connected by means of a separate small pipe to a cast-iron box, known as a "receiver," so situated that the water of condensation can flow into it freely by gravity. As the water in the receiver accumulates it is either forced or sucked up into the body of the special steam trap, which is situated about 4 ft. above the level of the water in the boiler. This special steam trap is of the float type, and consists of a float inside a cast-iron body. It is so arranged that when this cast-iron body is nearly full of water, the float then being near the top of the trap, actuates a roller which runs along a skate-shaped guide and automatically admits steam at full boiler pressure into the body of the trap. Now, as there is a non-return valve upon the inlet side of the trap, the water cannot pass again to the receiver, therefore we have a volume of water about 4 ft. above the water level in the boiler, and with full boiler pressure above and below it. Hence it flows by gravity into the boiler. The float drops back again into its original position, and at the same time cuts off the boiler pressure steam. The trap is then ready for another fill, when the above cycle is repeated.

There are, of course, a great many other equally ingenious devices, beside those dealt with in this article, but those already mentioned and described will, I think, serve the purpose of exemplifying the various principles upon which the modern up-to-date traps depend for their proper and efficient working.

THE PROPOSED ELECTRICAL LEAGUE.

A Criticism from a Manufacturer's Point of View.

By "MANUFACTURER."

During the past few months Mr. Garcke, of British Electric Traction and Brush Co. fame, has suggested the formation of an Electrical League with a view to studying the conditions existing in the electrical industry in this country, and of suggesting remedies for a state of affairs which everyone must deplore and consider unsatisfactory.

This proposed League, which was first suggested by Mr. Garcke last year, but was allowed to drop for want of adequate support, was recently resuscitated in the columns of the Engineering Supplement of the *Times*.

The following comments on the subject are written primarily from the point of view of the manufacturer, whose interests Mr. Garcke can scarcely intend to overlook in view of his close connection with the Brush Co.

Mr. Garcke proposes that his League should be comprehensive, embracing everyone interested in the electrical industry, whether as worker or shareholder. To quote his own words:—"The invitation to join the League should be extended to everyone who is in any way interested in electricity, whether as a shareholder, consulting engineer, town council, municipal station engineer, manufacturer, contractor or trader, whether employer or employé."

As a step towards setting the League on its legs, the following provisional committee has been formed:—A. K. Baylor, Lieut.-Col. H. R. Beddoes, A. N. Connett, B. M. Drake, E. Garcke, H. Hirst, M. B. Mountain, S. Rentell, Mark Robinson, A. A. C. Swinton, and A. G. Whyte.

It is to be feared that Mr. Garcke's efforts will prove of little avail, either in the direction of remedying conditions existing in the industry generally, or in the manufacturing industry in particular. A League of so comprehensive a nature is too liable to suffer from unwieldiness, and its meetings to degenerate into a mere debating society. At the best, its policy is liable to be dictated by a few of the more active members, possibly more anxious to further matters in their own interests than in those of the industry generally—by those probably requiring unnatural remedies to make a success of what others achieve by natural means.

Whilst dangers of this description must necessarily exist in the starting of any comprehensive scheme, however commendable, and must consequently not be considered an insurmountable stumbling block, it is desirable that these dangers should be avoided as far as possible, and that any policy promoted primarily in the interests of a limited number of the community should not be put forward as coming from a League representative of the whole industry.

In reviewing the proposals for this Electrical League, and in setting forth the following criticisms, the point is not overlooked that anything tending to improve the position of the electrical industry generally must necessarily tend to improve the position of the manufacturers themselves. But the danger would seem to be the one just mentioned, namely, that if a League is constituted as suggested by Mr. Garcke, the voting power would probably fall into the hands of a few individuals whose policy would be given out as representative of the feelings of the industry generally, and who could so easily out-vote the opinions of those less able to find the necessary time for putting their views before the public. It must not be overlooked that Mr. Garcke and his followers control probably a larger number of shareholders or members of the public than any other single group, and the majority of these shareholders—perhaps dissatisfied with the results they have obtained from his companies—would be liable to vote for anything that was held forth to them as likely to improve their position.

For these reasons the present suggested League does not appeal to many with satisfaction.

It would be a mistake to lightly pass over the unsatisfactory conditions of the electrical manufacturing industry in this country at the present time. In all probability this

branch of our industry requires more careful nursing than any other branch, but it is difficult to see how any League, as outlined by Mr. Garcke, is likely to be of any benefit to the manufacturing industry.

It is useless to enlarge upon the reasons which have brought about the unsatisfactory condition of the manufacturing section of our industry. Mr. Garcke has already ventilated his views in the Engineering Supplement of the *Times*, under date July 1st, 1908, and in this article he attributes the weakness of the manufacturing position to a want of demand in times gone by, for which the restrictions placed on the growth of the industry by Parliamentary powers are considered responsible.

Mr. Gisbert Kapp is unable to agree with Mr. Garcke's theories in this direction, and is inclined to say that the manufacturers have no-one to blame but themselves. It would, unfortunately, seem to be the case that Mr. Kapp's statement is more nearly correct than Mr. Garcke's; but it should not be forgotten, in passing, that in the earlier days of our industry a considerable set-back was experienced by the few manufacturers existing at that time (and who required capital for extending their business) by the blind Anglo-Brush speculation.

The manufacturing industry in this country has been built up primarily by engineers, and its foundations have been lacking in that commercial element which has gone so far towards strengthening the position of our Continental rivals. This state of affairs has resulted in the manufacturing capacity of our industry being divided amongst a large number of small manufacturers, who, whilst competing against each other at home to an extent which can scarcely be considered healthy, have been too small individually to hold their own against their more powerful competitors abroad.

In other words, the small firms have never grown into large ones, primarily due to the individuals at the head of the respective businesses. When the demand for machinery promised to exceed the supply, the leaders of our manufacturing concerns have been too timid to increase their capacity until too late, and have allowed others to start in competition with them, and to supply the demand which they themselves should have kept in their own hands. It requires a commercial policy to build up a large business. And there can be no question that a manufacturing industry divided among a few large concerns is healthier than an industry divided among a large number of small concerns.

Nothing less than a healthy recovery can improve the position of affairs. A healthy recovery can only take place after the process of a gradual weeding out of the unhealthy members. No artificial bolstering up can be of any advantage excepting as a temporary measure to the unhealthy members themselves.

Manufacturers have several times tried to arrange matters together, with a view to agreeing on conditions of contract, and with a view to limiting the fierceness of the competition at present existing between them, but they are unable to agree even among themselves; or, having agreed, are unable to abide by their undertakings. Is it therefore likely, if some 10 or 15 firms cannot agree among themselves to improve their position, that they are going to derive any benefit by anything constituted on the lines of the League suggested by Mr. Garcke?

When they are fully considered, the reasons why our manufacturers are unable to agree among themselves are not as unnatural as would seem at first sight. Any working arrangement between healthy and unhealthy members is unnatural, and can only be made at the expense of the healthy members. After the process of the "survival of the fittest" has taken place, then will be the time for some understanding among the survivors.

The electrical manufacturing industry in this country is one involving peculiar complications. Outside the smaller fry we have four large manufacturing concerns, as set out below; it will be gathered from their constitution how conflicting their interests are, and how impossible any understanding between them must be.

1. *Dick, Kerr & Co.*—Essentially a British firm, controlled by British policy and finance.

2. *British Westinghouse Co.*—A firm of American origin, financially disinherited by its American parent, and run on so-called British lines under American leadership.

3. *British Thomson-Houston Co.*—An American firm principally controlled by American policy and supported by American finance.

4. *Siemens Bros.*—A German firm entirely controlled by German policy and German finance.

In other words, there is only one firm of any magnitude in this country whose policy can be said to be British, and a knowledge of the complications existing in the manufacturing industry in America and on the Continent will at once convey the impression that any working arrangement between firms in this country, who are in any way connected with Continental or American firms, is difficult to bring about.

The conflicting interests are altogether too great when considered over the markets of the World, and not in our home market alone.

MUNICIPAL TRAMWAYS ASSOCIATION.

(Meeting at Nottingham, September 23rd and 24th, 1908.)

Ticket Check.

By L. Mackinnon (Traffic Superintendent, Glasgow Corporation Tramways).

This, as the name implies, is a paper on a subject in which the majority of our readers can have but little interest, and, as space is of particular importance at the present time, we refrain from abstracting from this highly instructive exposition of the routine which safeguards tickets and their cash equivalent on the Glasgow system.

To those who desire to read the paper we recommend a perusal of the *Tramway and Railway World* or the *Light Railway and Tramway Journal*, which are sure to print it in full.

Treatment of Corporation Employés Incapable of Performing Ordinary Duty.

By Alderman H. Linsley (Chairman, Salford Tramways Committee).

This question is one which becomes the more urgent of solution as time goes on. Motormen must be highly efficient, and must be relieved of their duties as soon as their health becomes impaired, but there is a limit to the number of lighter and less responsible positions which they can fill. The employé of a private firm who becomes incapacitated through age, or for any other reason, loses his employment, and Corporations will soon be face to face with the question whether such men are to be treated in a similar manner, or whether any reasonable means can be devised to deal with them.

The Workmen's Compensation Act provides for those who are rendered unfit for service as a result of accident, and in many cases these men receive assistance from other sources, such as Trade Unions; but, apart from this class of incapacity, there is the class into which fall the men who become inefficient from old age, or from causes which may be traced to the nature of the employment, or from causes which are quite outside the man's work.

The present Old Age Pension scheme cannot help the tramway employé very much as the age limit is too high, but several of the larger municipal tramways have taken steps in the matter.

The Glasgow Corporation Tramways Friendly Society started a superannuation fund in 1899, the revenue being derived from weekly contributions of 1d. from each member plus a 1d. per member from the Tramways Committee. The proceeds from the sale of unclaimed property, all money found on the cars, and the conductors' "overs," go to swell the fund, and nothing is to be drawn until 1911. No member is eligible for relief until he has been in the service and a member of the society for 15 years, and he has to be physically unfit for any departmental work before he can draw on the fund. At the end of 15 years' service an employé is entitled to a retiring allowance of 10s. per week, rising to 20s. per week after 25 years' service. At the end of

1911 it is estimated that the untouched fund will amount to between £30,000 and £40,000.

A similar scheme is in operation on the Liverpool Corporation Tramways, and Belfast has gone further still by extending the operation of the scheme to cover all the weekly wage-earners in every department of the Corporation.

Any benefit and pension system of this nature opens a wide door, and it may be asked what is to prevent every branch of a municipality from forming societies, paying a small sum in, and looking to their respective committees to make grants? How is this going to affect the non-earning departments? It would make the lot of the already overburdened ratepayers harder still, and some might ask what right have we to grant pensions out of the rates to our employés?

That is the gist of Alderman Linsley's paper, and it opens the way for a highly controversial discussion. For our part, we feel that the logic of the thing is to grant to all departments what you grant to one, making no distinction between so-called revenue-earning departments and those which are not even supposed to earn money.

It would be just as logical to refuse to pay wages to the employés of a Street Cleansing Committee as to cut them out of a mutual benefit scheme on the ground that their work brings no direct profit to the citizens.

The real question is whether a corporation has the right to make grants of public money to a section of the workers in a community, and that question is one which is much too wide and much too important to be discussed in the limited space at our disposal.

As a scheme which cannot fail to promote thrift and steadiness and loyalty to the service, we think the Glasgow Corporation Tramways Benefit Society worthy of great praise, and, whether it is right or wrong from a sociological and economical standpoint, we would fain see such societies spread throughout the land. If they were more common, we should have heard nothing of a non-contributory, indiscriminate, and anti-thrift Old Age Pensions Act.

Some Through-Running Problems, and their Solution.

By H. E. Blain, Manager, West Ham Tramways.

The paper aims at classifying the main principles upon which experience has shown that through-running can be arranged to the general advantage. That through-running is advantageous was shown by the experiences of Newcastle, Birmingham and Edinburgh. For instance, prior to through-running between the Newcastle Corporation and the Tyneside Co.'s lines, the Newcastle cars brought in one month 48,000 passengers to their terminus, of which number the company carried on 11,000, leaving 37,000 who preferred to walk. In a month of similar seasonal conditions after through-running, the same number of passengers arrived at the Newcastle terminus, but 36,000 were carried on to the lines of the company.

There are still many tramways which scout all proposals for through-running, thus depriving themselves and the public of considerable benefit. In the London area it is certainly one of the strongest reasons for the establishment of a Central Traffic Board that some of the authorities continue to refuse these facilities, and it is to this short-sighted policy that much of the motor-'bus competition is due.

The main classes into which through-running arrangements divide themselves are:—

Class A.—In which foreign lines are leased and run by another authority.

Class B.—In which both contracting parties run cars; and each through passenger receives two tickets, either by a change of conductors at the boundary, or by each line furnishing the other with its own tickets.

Class C.—In which both authorities run the number of cars proportioned to their respective mileage, the areas being taken as of equal earning value, and each authority retaining its own receipts.

Class D.—In which both authorities run cars, and the receipts are apportioned upon an agreed basis.

Actual working examples of each class are given, with the payments made by the contracting parties, and it is noticeable that no two arrangements are alike, and some are highly complicated in appearance, although they probably work well enough in practice.

The paper ends with condensed notes on the chief points which are found usually in through running agreements, and we add our hope to Mr. Blain's, that the paper may help to do something to show those authorities who continue to obstruct through-running, that such facilities are not difficult to arrange, "are fair and remunerative to all parties concerned, are of the greatest value in stimulating traffic, and are a public and private convenience which no authority which claims to be the representative of the public and the guardian of the public weal has a right to hinder."

Discussion on Mr. Blain's Paper.

Mr. James Dalrymple, general manager, Glasgow Corporation Tramways: There is no doubt whatever that this will be a very valuable paper to us as a paper for reference. Some mistakes have crept into it evidently, but possibly on the issue of the paper for publication these mistakes may be corrected so that we may be sure of our ground in reading through the paper again. Mr. Blain refers to through-running between Glasgow and Paisley. Shortly the arrangement is this: The Paisley Co. have withdrawn all their cars from the portion of line on which we have running powers. The length of the line is exactly one mile, divided into two halfpenny stages. The Paisley fare of 1d. would carry a passenger half a mile further. That is to say, the 1d. stage is one and a half miles. The Paisley Co. before the arbitration wanted a full 1d. from Glasgow for the passenger who rode over that mile because they said they would get 1d. But we contended that the passenger would be able to travel half a mile further, and consequently they were only entitled to the proportion—namely, two-thirds of a penny, and that is the amount which the Paisley Co. receive from Glasgow for their through passenger.

Mr. J. B. Hamilton, general manager, Leeds Corporation Tramways, said: Mr. Blain, in the very able and painstaking manner in which he has drawn out his paper, has classified the different forms of agreement under classifications, and he places the agreement between Leeds and Wakefield under Class "B," Class "B" being one in which there is through-running, but two tickets are given to through passengers. I can quite conceive that with the multiplicity of agreements, and the complex character of those agreements which were placed before Mr. Blain, he may have overlooked the fact that in that agreement there are no two tickets for through passengers. In fact, the agreement between Leeds and Wakefield, which I think I am right in saying, was one of the first which was voluntarily entered into between two different undertakings, has practically become standard, and under that agreement each authority runs cars in the other's district, and each authority is supplied with the tickets to be issued in their own district—except in the case of through fares which are issued by the department—by the undertaking in which they are initiated, so that a passenger desiring a through fare can, by one payment, get a ticket which takes them right through. In addition, Sir, the same correction applies to the proposed agreement, which is also referred to on the same head between Leeds and Bradford. In that case, we had very unique conditions to deal with in regard to the track, but so satisfied were the two Corporations, Leeds and Bradford, of the advantage of through running, that we were even prepared to go to very considerable expense, and put down additional rails. I should, perhaps, remind the members who do not know the facts that there are two different gauges. We run up to each other's lines—in the case of Leeds, with a 4 ft. 8½ in. track, and in the case of Bradford, with a 4 ft. track—and that for a long time seemed an insuperable difficulty, which it was impossible to get over. However, through the ingenuity of my colleague in Bradford, who has devised a dual axle, we find that it is now possible to run cars right through from the centre of one system to the other, and the agreement which is going to come into practice very soon is the result of that. In that case, you see, there will be a through fare to a through passenger. That is, a passenger will pay one fare and get right through from end to end. Mr. Blain points to the fact of this important subject not yet having received the attention of this Conference. As one who is considerably acquainted with the work of the Conference in the various areas, I may say that we have frequently had suggestions with regard to this matter, but considering the views of many of the members of the Association, which, at one time were, at any rate, neutral with regard to it, and some of them rather antagonistic, it was decided that the time had not yet come when a paper of this kind, laying down conditions which might be unsatisfactory to many of the members, should be considered. The invariable success which has followed through-running, wherever adopted, entitles us to say that the time has fully arrived when a consideration of the various arrangements which are in use to permit through running is very opportune, and I think, Sir, the time to deal with it has also come.

Mr. J. M. McElroy, general manager, Manchester Corporation Tramways: Mr. President and gentlemen, this paper of Mr. Blain's is valuable on two grounds. First, it gives us excellent examples of "Blainisms," and secondly, it gives us a reason why through-running

arrangements are in operation, which will be valuable to us for reference in time to come. Mr. Blain starts out by saying his aim is to classify the main principles upon which through-running can be arranged, and he gives us his classification. I don't quite agree with the use of the word "leased" under Class "A." We, in Manchester, have had some considerable experience in making arrangements for through-running, seeing that we have to run into the district of some 21 other authorities, so we have been "up against" rather a big proposition. Seventeen of these authorities have leased their lines to us. That is to say, we pay them an actual rent for the lines, and they don't care what we earn on them at all. We have to maintain the lines, renew them, supply the cars, current, and do the whole thing, paying them an annual rent. That is what we call "leased" lines. Then, on the other hand, we have certain running arrangements in which the line-owning authority is interested in the receipts, and the broad principle which underlies the whole agreements in regard to this running arrangement is that the line-owning authority gets the whole receipts within its area. That is the broad principle on which the running arrangements are made. I take it generally all through-running arrangements are that the line-owning authority gets the receipts in its own area. There may be differences as to how that is got out, as, of course, every case has to be considered on its own merits. But the underlying principle is, I take it, the same. I am quite sure every tramway manager now—and we have all been through the mill—will see the great difficulty of obviating artificial boundaries. There is no doubt that we and Ashton, we and Oldham, we and Salford are all benefiting by these through-running arrangements, and it is for the convenience of the public which is the first consideration. I don't know that I have anything to say as to the delightfully simple arrangements Mr. Blain speaks of between Manchester and Salford. We have a fixed sum per track mile. The arrangement was arrived at under these conditions. We were running certain cars to our boundary on two routes, and Salford said, "We want to run into your district; you take your cars off." We knew exactly what those cars were earning, and that is what they are paying us. It is just another illustration of the same principle. They pay us what they earn in our own district. The main principle is that the line-owning authority should have the whole of the receipts earned in its own area.

Mr. H. Mozley (general manager, Burnley Corporation Tramways) said: Mr. President and Gentlemen, I do not think it is the tramway managers that require convincing, it is the members of the Committees and boards of directors, and, therefore, I should very much like to hear what they have to say why these through-running arrangements should not exist universally. It has now become extremely easy to settle, so that every interest shall be secure, and it is obvious that the public interest will be served, and that of the tramway owners as well. Therefore, I say there need be hesitation no longer. Descending to details, I would just like to ask Mr. Blain why he has not referred to the light goods and parcel traffic as well as the desirability of carrying passengers through a district. I just want to say "Thank you" to Mr. Blain for the useful way in which he has presented the information, and so long as it is corrected, for mainly criticisms are corrections, and put upon our files at home, we should thank him for what he has done.

Alderman Ivey (West Ham County Borough Tramways) then gave the meeting one of his long-winded orations, to which we have become accustomed, and which appeared to us more like a denunciation of the London County Council and its estimable manager, Mr. A. L. C. Fell, than as serving any useful end; the attempt, backed up by a little coterie of West Ham sympathisers, to "draw the badger" failed dismally.

Mr. Stephen Sellon said: The point, I think, if I may be allowed to suggest it, is that which is stated on the preamble of every Bill or Act which is passed for the construction of tramways, namely, that "the same shall be for the purposes of public and local advantage." Now, Sir, therefore, it is not only for local advantages, but they are also constructed for the purposes of public advantage, and I am sure it is a pure question of business and ought to be dealt with as a question of business between all parties. There is nothing so alarming as it appears in the question of running powers. Running powers have been in use from quite an early date. The original railways, everyone of them, were bound, and are bound to-day, by the Railway and Canal Traffic Act of 1856, to take any train that I put upon their railways to-day. There is not a single railway company built under any of those Acts that I cannot demand, and put my own train on to take my own goods, and myself as well. That is only coming back exactly to the same principle that is asked to-day—that we on another tramway can put our own cars, and run not only for the benefit of ourselves but for the benefit of the owners of that tramway, and finally, Sir, which is the most important, for the benefit of the public at large who use them. Nottingham has nothing to reproach itself with, I am glad to say, Sir, in that respect. I believe I am right in saying that they have seen the advantage, and have adopted a public spirit in regarding the fact that a company from outside gathered in the inside is as valuable to them as a company got inside Nottingham. Therefore, they have allowed a company to come into Nottingham giving them an additional income by the means of giving such facilities. That is a little prudent business dealing which I recommend to all those here present to-day in all cases where such circumstances occur. Now, Sir, let us deal with one other matter which has been dealt with by one or two members who are suffering from this unfortunate state of things. I think probably their feelings run high, but it is advisable in all these matters to avoid personalities. Mr. Fell is one of those gentlemen who do not mind a give-and-take. I have tried to attack him a good many times, but I have always found him come up smiling, and I am sure he will take it all in good part. We do not know all the inside of Councils and all the inside of officers. Councils have their own views, and an officer cannot always call upon a Council to do that which he wants them to do. Therefore, it is impossible to say who is to blame, but there is no doubt we have a right to attack not the individual but the principle, and that therefore when Croydon gets up, or anybody else gets up, and says "we are ruined to-day by our tramway business, we are ruined by the motor-'bus," it is right that the reason should be known why we should be ruined and how it can be prevented. If you will just take the one case of Croydon, here you have got a tramway system, and a very important tramway system, ending at a little place called Norbury, and from there you have got a gap extending, I believe it is, for a mile and a half, to Streatham. Then you get the County Council tramways running into London. Now, what happens? A motor-'bus starts from one end of Croydon, and it takes every through passenger who wants to go towards London—takes them to London. What is offered by Croydon to unfortunate passengers who get in at the end of Croydon is, "you may travel in our tram as far as Norbury, and then you may please get down, and you may walk a mile and a half, and then you will be allowed by the permission of Mr. Fell to get into the London County Council's system, and then you can get to London. Now, that is the position, which, I venture to say, is an absurdity. I think it ought to be remedied, and I am sure amongst business men that is a matter which will shortly be dealt with.

Mr. A. Baker (general manager, Birmingham Corporation Tramways): I just want to say this, that much of the trouble with regard to through-running no doubt arose in the early days of municipalisation, and it was due to the very strenuous fights the various municipalities had with the company owning the lines before they became possessors of the tramways. Many millions of public money were invested in tramway undertakings all through the United Kingdom, and it is not to be wondered at that municipalities guarded with very jealous eyes the properties they had so dearly bought. What I want to say is, it is necessary to differentiate between mutual through-running arrangements and compulsory running powers. Personally, I have always held it is quite a proper and simple thing to make mutual arrangements for one authority to run into the area of another. But at the same time I have always been very bitterly opposed to anything in the nature of compulsory running powers being obtained. In Birmingham we have at the present moment running powers with several outside authorities. We have running powers with the British Electric Traction Co. When I say running powers, I mean mutual running arrangements. At one time nobody would have thought it possible to have had a mutual arrangement with that company, but, as a matter of fact, we have such arrangements, and I may tell the conference there is not a scrap of paper between us, nothing in the nature of an agreement, and yet we run into each other's areas without the slightest difficulty or trouble. But I want you to bear in mind that in 1903 that company promoted a Bill in Parliament for compulsory running powers through the whole of Birmingham. They said that mutual arrangements were impossible, and it was necessary to have compulsory running powers. Parliament in its wisdom did not give them the powers they sought, and having failed in that, like good and sensible people, they said we are now prepared to make mutual arrangements with you, and these have been running very satisfactorily ever since. There is only one condition to be observed, and that is, that one authority shall not make a profit at the expense of another. Given a condition of that kind, there should not be the slightest difficulty in making a mutual arrangement not only to the satisfaction of the authorities concerned, but of the public at large.

Mr. A. L. C. Fell (general manager, London County Council tramways) Mr. President, although I am not a badger, and don't think I have been drawn, I wish to correct one or two statements made with regard to the running arrangements proposed by the County Council. Mr. Sellon just now dealt with the question of Croydon. The County Council has for years past been endeavouring to get a tramway through from Streatham to the County boundary, but owing to the opposition of the local authority, it has been unable to do so until this Session. We have just succeeded in getting through Parliament powers for a line between Streatham and the County boundary at Croydon. Surely the question of a through line can only be considered when the tramway is constructed. We might just as well enter into through arrangements with Mr. Wilbur Wright or someone of that sort at the present time. As to the question of West Ham, I am perfectly certain Mr. Blain himself was not trying to draw me on the question of through running, because at the present time we only go near West Ham in two places, one at the terminus at Bow and the other down at Poplar. The trams at Bow are at present run by horse traction, and there is, of course, a difficulty in having through running between horse traction and electric traction. In the other case there is a gap of something over half a mile, and we had it put upon us by Parliament that if we constructed that connection between West Ham and our line we should have to buy half a street, and pay for it, and the County Council at present think that the money which would have to be spent on that widening might be very well spent on the electrification of some of the other horse lines in London. We have already entered into arrangements with outside authorities from London. We have it with Bexley at the present time. We are now in negotiation with the Metropolitan Electric Tramway Co. for running to Harrow Road with through-running powers possibly down to Willesden. And we also have leased a portion of the line in Archway Road, and in many other directions. I feel certain of this, if it was to the public advantage, the London County Council would be the first to adopt running powers on

other sections. But I feel most strongly that on the lines where we have 10 to 14 miles in a straight line, there is no advantage in extending them outside the county boundary. The President tells me I have to stop. I am sure we have had a very interesting discussion, and obtained a lot of very useful information. I propose a very hearty vote of thanks to Mr. Blain for his paper on this interesting subject.

The vote was taken, and carried with acclamation.

RAISING THE STANDARD OF ILLUMINATION.

The introduction of metallised-filament and metal-filament lamps into commercial use has now progressed to a sufficiently great extent to have enabled a large amount of experiment with regard to their application to have been performed, and the literature of the subject has been correspondingly developed. This is particularly the case in America, where the habit of giving publicity to the results of investigations appears to be rather more strongly developed than in England. As a result, we have such a paper as that contributed by Mr. George Loring to the recent convention of the National Electric Contractors' Association, held at Chicago in July last, under the title of "Electrical Contractors' Opportunities in the Illuminating Field," and reported in our contemporary, the *Electrical Record*.

The chief point, which constitutes a new feature in the design of lighting installations, is the fact that the choice of units of electric intensity is not now limited to 8, 16, and 32 candle-powers for house lighting. It is now practicable to use lamps of 40 or 50 candle-power and high efficiency on the one hand, while in conjunction with them the use of 14-watt (3 c.p.) or 19-watt (4 c.p.) carbon lamps is recommended. As Mr. Loring points out, "The system in vogue of electrically lighting houses lacks elasticity; it is on a 'feast or famine' basis." Therefore very many sections of a house are left in darkness after night has fallen. This in practice has the effect of decreasing the central station load-factor by accentuating the peak load; and the correction of this fault by the electrical contractor advocating a system of low illumination throughout a house, not only brings him into line with the lighting authorities, but opens up a very profitable source of revenue from people who would willingly pay to have their system overhauled for the purpose of giving greater uniformity in illumination throughout the house with a possible saving on their current consumption. A great number of people would also place additional orders for tungsten units, which may be installed by the contractor at the time when the low illumination work is being done.

Mr. Loring gives as an example a nine-room three-storey house with a piazza in front. Above the verandah, one foot out from the middle of the front door, he would place a 3-c.p. lamp with Holophane reflector producing an illumination of 0·2 foot-candle on the centre of the door, lighting up the house number, the piazza, steps and a portion of the path leading to them. Additional to this would be a 40-watt tantalum or tungsten, or a 50-watt metallised filament lamp for reading purposes on the verandah. The hall, living room, dining room and kitchen can each be equipped with a 14-watt lamp for use between dusk and the hour for retiring. On the second floor hall a 14-watt lamp can be kept burning at night and the same intensity can be used in the bathroom. The lamps are supplemented by high-power high-efficiency lamps for times when strong illumination is required. With current at 10 cents per unit it only costs ¼ cent per hour to operate a 14-watt lamp, and Mr. Loring states it to be possible to read a newspaper by the light of such a lamp anywhere within 12 ft. of it, in a dark-green papered room. He points out that such a scheme should recommend itself to householders as a very cheap and effective burglar protection. The house is also far more cheerful, as instead of some parts being dark and gloomy, everything is comfortably lighted. The general principle involved is the planning of the house lighting so that each lamp is placed where it is most needed, and employing only those lamps which are efficient to the highest degree commercially, and equipped with accessories which will aid them in producing the necessary illumination at the lowest total cost.

For shop light Mr. Loring believes emphatically in the use of the tungsten lamp. He says, "If a person is already using electric light in his place of business, advise, with few exceptions, the use of tungsten lamps over all other illuminants." Provided the installation is as efficient as possible with cellulose-filament lamps, replace three 16-c.p. cellulose-filament (carbon) lamps by two 40-watt tungsten lamps. With current at 6 cents per unit, a net saving of 20 per cent. is thereby obtained, with an increase of illumination of 33⅓ per cent.—net saving meaning that if a person using carbon lamps is receiving them free, the saving on lighting amounts to the figure quoted after deducting the price of the tungsten lamps. Even with energy as low as 3 cents per unit, a net saving is secured with equal illumination by using tungsten lamps. The attached Table I is compiled to show the economies effected by tungsten against arc and Nernst lamps, and speaks for itself, while Table II compares gas arcs with tungsten lamps. Tungsten "arcs" containing either five 60-watt or three 100-watt lamps give a more satisfactory illumination than a Welsbach 4-burner gas arc, and with gas at one dollar per thousand cubic feet and electricity at 7 cents per unit the operation expenses of tungsten lamps compare favourably with those of their gas rivals. Two 100-watt tungsten lamps will produce better results than a 4-burner Humphrey gas arc. In this case the cost of lighting will be no greater with the tungsten lamp, when energy is 9 cents per unit and gas one dollar per thousand cubic feet. It is preferable to arrange that one tungsten lamp and shade constitutes a lighting unit in a scheme of shop illumination, in preference to having clusters, in order to avoid uneven illumination. Four lamps properly placed will frequently give better results than five or six installed in a cluster.

In order to give good results, the illumination should be highest and apparently equal and uniform on the objects which have to be brought into prominence. Other secondary surfaces should, if possible, be more lowly, and to a certain extent unevenly, illuminated, to eliminate flatness in the lighting scheme. Moreover, the illuminants themselves should be of such a character and so placed that their presence is not noted. All lamps within the range of ordinary vision should be concealed by reflectors, though low candle-power lamps may be frosted. Wall brackets, with few exceptions, should only be used for decoration purposes, and should have lamps of not more than 4 c.p., frosted. To avoid the casting of shadow upon a counter or show-case by people standing in the shop, the lamps, if possible, should be located, not over the aisles, but over the middle of the counters or show-cases.

Mr. Loring has also prepared a list, giving, among other things, the tungsten lamps now produced commercially. These are 40, 50, and 100-watt 100-130-volt lamps with straight side bulb, or 40, 50,

TABLE I.

Tungsten cluster.	M.L.H.-S.C.P.	Total watts.	Arc lamps.	M.L.H.-S.C.P.	Total watts.	Total watts saved per hr. by Tungstens.
Three 100-watt Tungsten	240	300	D.C. 5½-amp. clear inner, opal outer globe.	224	630	330
Three 100-watt Tungsten	240	300	D.C. 5½-amp. opal inner, clear outer.	237	630	330
Two 100-watt Tungsten	160	200	D.C. 5½-amp. opal inner, opal outer.	171	630	430
Two 100-watt Tungsten	160	200	A.C. 5·7-amp. opal inner, no outer.	175	600	400
Three 100-watt Tungsten	0·60 328	300	Concentrat'g diffuser 8½-amp. A.C. arc lamp.	0·60 327	645	345
Two 3-Glower Nernst v. Three 100-Watt Tungstens.						
Three 100-watt Tungsten	240	300	Two 3-glower Nernst.	240	554	254

TABLE II.

	M. L. H. C. P.			Consumption.	Cost per hr. gas @ $1·00 per 1,000 cb. ft. Elec. @ 10c. per KW.-hour.	M. L. H. C. P. per 1 c. per hr.			% Useful lt. for equal cost considering Holophane with 5-60 or 3-100 wt. lamps as 100.		
	Initial.	After 100 hrs. service.	After 300 hrs. service.			Initial.	After 100 hrs. service.	After 300 hrs. service.	Initial.	100 hrs.	300 hrs.
Welsbach 4-burner gas arc	281	225	188	21 cb. ft. per hr.	·021	134	107	90	167	130	112·5
Humphrey 4-burner gas arc	168	135	112	18 cb. ft. per hr.	·018	93	74·4	62	117	90	77·5
Average (Welsbach-Humphrey)	224	179	149	19·5 cb. ft. per hr.	·0195	115	92	77	144	112	96
Holophane, tungsten cluster, five 60-watt or three 100-watt tungstens with Holophane No. 6,060	240	248	240	300 wts. per hr.	·03	80	82·4	80	100	100	100
Two 100-watt tungstens with Holophane No. 6,060	160	165	160	200 wts. per hr.	·02	80	82·4	80	100	100	100

and 75-watt street series tungsten lamps, of voltages ranging from approximately 6 to 19. The efficiency of these lamps is 1·25-watt per candle, while their average useful life on direct or alternating current is 800 hours and upwards. He also states that not more than four months from the date of the convention will have passed before 20 or 25-watt and 250-watt 100-130-volt tungsten lamps will be on the market. Within that time there will also probably be produced a 50-watt, 200 to 225-volt tantalum lamp.

THE RUBBER EXHIBITION.

RUBBER is of interest to the electrical engineer mainly in its manufactured form; to manufacturers alone is it given to understand the processes through which the raw material has to pass before it is transformed from milky sap to the resilient insulating material to which the electrical industry owes so great a debt. Few materials used in the arts are subjected to such a curious variety of methods of preparation in the early stages of their career; the latex, for instance, can be coagulated by smoke, heat, dilution, evaporation, beating, and treatment with various acids—all of which processes are in use more or less, generally in a somewhat primitive fashion, in the tropical regions in which alone the rubber-producing trees can thrive. Naturally the various brands of raw rubber obtained in these divers ways differ widely in quality, though probably if scientific methods of coagulation were universally adopted a much more uniform result could be attained. At present the system of smoking in vogue in Brazil is the best, producing the purest and most durable qualities of rubber, and it is largely to this fact that the high reputation of Para rubber is due.

But when once the raw material has been isolated, its later treatment follows on fairly standard lines. It is first carefully washed and dried with the aid of powerful machines, in which it is rolled and kneaded repeatedly until it is freed from the impurities with which crude rubber is invariably contaminated. It is then in the form known as "pure rubber," an expensive substance, but in itself of but limited utility. It is at this point that the niceties of rubber manufacture come in. Mark Twain is reported to have said, as a guide to the writer of history, "First get your facts; afterwards you can distort 'em as much as you like." Here the pure rubber may be regarded as analogous to the facts; vulcanised rubber to the history evolved from them by scientific manipulation. For the process of vulcanising, or curing rubber by treatment with sulphur in various ways, which transforms the pure perishable rubber into a resilient and durable material, unaffected by ordinary temperature changes and practically waterproof, is but one phase of its manufacture. The pure materials are loaded with mineral powders, organic compounds and colouring matter until there may be no more, or even less, than 50 per cent. of rubber present in the resulting mixture. By this means the cost of material is reduced and the quality is often greatly improved in many respects. The art of rubber manufacture very largely consists in the discreet and intelligent compounding of the ingredients which go to form the finished product, and there are probably few industries in which the secrets of manufacture are more closely guarded or more difficult to unravel than in the one of which we speak.

It follows, obviously, that we can here deal only with the machinery employed in the mechanical stages of rubber manufacture; and that only briefly owing to the pressure on our space.

MESSRS. FRANCIS SHAW & CO.—This firm, one of the oldest manufacturers of rubber-working machines, exhibited a compact pair of machines for washing and crêpeing, as used on rubber plantations. The crude rubber is first passed several times through the washing machine, which is provided with diamond-cut rollers for the purpose of breaking up the material and removing sand and other impurities. It is then passed through the crêpeing machine, which is fitted with plain rollers, and turns out the rubber sheets in crêpe form, ready for drying. The two machines are driven by belting, and are coupled together with a Hele-Shaw patent friction clutch; the gearing is double-helical, machine cut. Hoppers and tanks are fixed under the machines, and a special feature of the set is a small pump which automatically supplies water to the rubber between the rollers when the machines are in motion. Settling tanks and strainers keep the circulating water clean. Another exhibit was a double-ended hand-operated hydraulic press for compressing rubber into blocks about 9 in. × 9 in. × 3 in.; while one block is being compressed, the other stands under pressure until set, so that there is no loss of time in waiting. The presses are provided with automatic return springs, and with a water tank; the whole machine is self-contained, light and compact. A steam-heated hydraulic press for vulcanising small articles, a motor-driven waste rubber grinding machine of powerful construction, with emergency stop-buttons and safety bushes, the Scott vacuum drying stove, and a comprehensive display of photographs of work done by the firm, were amongst the other exhibits on this stand.

MESSRS. DAVID BRIDGE & CO.—This firm, which is also one of the pioneers in rubber machinery, exhibited in operation an electrically-driven washing, sheeting and crêpeing machine with grooved rollers, which are connected by means of Heywood & Bridge's patent friction clutch. A heating apparatus for heating the water so that hard rubbers could be softened before passing through the machine was provided. A sheeting machine with double-geared plain rollers, prepared for heating and cooling, and a hydraulic rubber block press with patent interchangeable boxes, were shown, together with Da Costa's experimental plant, which was made out in Brazil to demonstrate the coagulation of latex in bulk, by smoke. A complete plant for the coagulation of latex was working in the Exhibition grounds. Another exhibit was a Baker patent separator for extracting all oil and grease from steam, which is essential where vacuum dryers are heated with exhaust steam; and a variety of drying racks, shafting, pulleys, &c., were shown.

MESSRS. ROBERT WARNER & CO., LTD.—On this stand a crêpeing machine, a sheeting machine with patent hot rollers, and a steam pump were the principal exhibits.

MESSRS. WERNER, PFLEIDERER & PERKINS, LTD.—A novel machine was shown by this firm in the shape of a patent "Universal" washer, provided with interlocking rollers somewhat after the fashion of double-helical gear wheels, between which crude rubber is continuously kneaded and washed without requiring the constant attention and feeding usually necessary. The rubber is repeatedly passed through the rollers by automatic means, the operation being completed within about 1½ hours. Provision is made for the automatic removal of dirt, sand, &c., and for the recovery of any small pieces of rubber that may escape with the *débris* from the machine. Machines for washing and masticating rubber, and mixing machines of various kinds were also exhibited here.

Telephone Connections.—In *La Lumière Electrique* of the 12th inst., Mr. L. Sabatier discusses a new mode of connections for short-distance telephones without induction coils. As ordinarily used, for two stations, the batteries, transmitters and receivers are all in series, and the resistance of the transmitters being small, compared with that of the rest of the circuit, the variations of resistance of the microphones produce proportionately small variations in the speaking currents. Mr. Sabatier proposes to place the microphones in shunt to the respective batteries, while the receivers remain in series with the line; the batteries are connected in opposition. Under these conditions, the variations of resistance of the microphones cause far greater changes in the speaking currents, with corresponding improvement in the efficiency of transmission. The system depends upon the fact that the batteries possess internal resistance; were they without resistance, the variations of potential difference at their terminals with changes in the microphone currents would be reduced to a very small value, caused by electrolytic effects alone, and the system would fail. The best results are obtained when the resistance of the microphone is about equal to that of the battery, and the author gives calculations showing that the transmission with his arrangement is more than eight times as good as with the ordinary connections. There is, he says, no difficulty in connecting a station thus coupled up in communication with a station fitted with an induction coil, and he gives a complete diagram of connections for the station.

Nationalisation in Switzerland.—The Cantonal authorities of St. Gall, following the example of the Canton of Zurich, propose to establish State electricity works and a network for the supply of light and power to the communes, and in this way to counteract the private monopoly which the large electrical companies, such as the cable works near Herisau and the Motor Co. near Baden, are in course of acquiring. A considerable portion of the canton has already become bound to these companies by the conclusion of agreements for the supply of power. At a recent meeting of the Grand Council the Government were requested to withhold from private undertakings the water powers existing in the canton, which are not yet utilised, and to conserve them in the public interest. As a consequence the Government Council now proposes that further State electricity works should be established in the valley of the Tamina above Ragaz and at the Thur in Obertoggenburg where the conditions are favourable for the erection of works. A State works already exists on the Rhine valley inland canal for the supply of the Upper Rhine valley with light and power and the delivery of power to the Altstatten-Berneck electric tramway. It is intended in the first place to include in the State networks those portions of the canton which are not yet connected with a power station. The communes and private consumers who are still under contract with companies have been requested not to renew the agreements on their expiration.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

19,299. "Protector or shield for the protection of the earthenware insulating cup from damage through stone throwing, or otherwise, in the telephone or telegraph service." J. Taylor, J. B. Manuel, C. Rees and W. Leach. September 14th.

19,263. "Improved insulating process for electrical machines." Felten and Guilleaume-Lahmeyerwerke Akt.-Ges. (Date applied for under Sec. 91 of the Act, September 14th, 1907, being date of application in Germany.) September 14th. (Complete.)

19,265. "Improvements in or relating to electric furnaces." A. Le Roy Marsh. (Date applied for under Sec. 91 of the Act, September 19th, 1907, being date of application in United States.) September 14th. (Complete.)

19,299. "Improvements in and relating to the control of alternating electric current motors of the commutator type." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 14th.

19,308. "Improvements in telephony, more particularly applicable to long-distance transmission." E. C. Buck and C. Isaac. September 14th.

19,309. "Improvements in selectors for automatic telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) September 14th. (Complete.)

19,311. "Improved manufacture of incandescence bodies of tungsten." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, September 26th, 1907, being date of application in Germany.) September 14th. Complete.)

19,324. "Improvements in electricity integrating meters." R. Kennedy. September 14th.

19,325. "Clip for testing sparking plug of motor cycles." W. Lumsden. September 14th.

19,333. "Improvements in the method and means of transforming electrical energy into heat energy." C. O. Bastian. September 15th.

19,357. "Trolley heads." L. Bailey. September 15th. (Complete.)

19,365. "Improvements relating to holders, sockets or like attachment fittings for electric lamps." F. W. Bayliss. September 15th.

19,388. "Interrupter for ignition apparatus and the like." C. Ebner. September 15th. (Complete.)

19,395. "Improvements in or relating to electric arc lamps." H. J. J. Jaburg, jun. September 15th.

19,411. "Improvements in or relating to speed controlling or governing devices." W. O. Chalk. (Date applied for under Rule 18, January 3rd, 1908. An invention comprised in Application No. 15,355, dated July 3rd, 1907.) September 15th. (Complete.)

19,443. "Improvements applicable to telephones." J. Pilling. September 16th.

19,450. "Improvements in electric telegraphy." A. Muirhead. September 16th.

19,457. "Improvements in telephone instruments." W. Aitken. September 16th.

19,458. "Improvements in electrically-driven turret clocks." E. J. D. Newitt and A. B. Webber and The Standard Time Co., Ltd. September 16th.

19,464. "Improved combinations of steam and electric motors, electric generators, and screw-propellers for marine propulsion." R. K. Morcom. September 16th.

19,482. "Improvements in trolley heads." F. G. Holmes. September 16th.

19,485. "Improvements in and relating to dynamo-electric machines for operating rolling mills and the like." British Thomson-Houston Co., Ltd. (Allgemeine Electricitäts-Gesellschaft, Germany.) September 16th.

19,486. "Improvements in regulators for alternating electric-current circuits." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 16th.

19,501. "Condenser for electric ignition apparatus." C. Ebner. September 16th. (Complete.)

19,502. "Improved bearing with lubricating device for the armature shaft of electric ignition apparatus and the like." C. Ebner. September 16th. (Complete.)

19,504. "Improvements in expanding plugs for electrical purposes." F. Buckle. September 16th.

19,548. "Improvements in gravity electrical switches." E. E. Moore and W. Powles. September 17th.

19,573. "Improvements in or relating to switch mechanism for rail and tramways." September 17th.

19,574. "Improvements in or relating to the manufacture of insulating tubes." Felten & Guilleaume Lahmeyerwerke Akt-Ges. (Date applied for under Sec. 91 of the Act, September 18th, 1907, being date of application in Germany.) September 17th. (Complete.)

19,589. "Improvements in and relating to electric circuit-breakers." British Thomson-Houston Co., Ltd. (General Electric Co., United States) September 17th. (Complete.)

19,599. "Improvements in and relating to electric motor controllers." E. Shattner. September 18th.

19,620. "Improvements in cartridges for use with electrically-fired small arms." H. Whittington. September 18th.

19,621. "Improvements in and relating to the suspension of trolley wires for electric tramways and railways." J. G. Scott. September 18th.

19,634. "Improvements in magneto-electric generators for producing ignition of explosive mixtures in the cylinders of internal combustion engines." R. H. McEwan and A. W. Pratt. September 18th.

19,659. "Improved process for making incandescent filaments for electric lamps." W. P. Thompson. (O. von Inwald and R. von Inwald, Austria.) September 18th. (Complete.)

19,679. "Improved safety device for portable electric hand lamps." J. Lightfoot. September 19th.

19,720. "Improvements in or relating to arrangements for securing the end-connections of rotors of dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) September 19th. (Complete.)

19,724. "Improvement in electric switches." C. E. Hunter and C. W. Zoephel. September 19th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1907.

Electric Motor Equipments for Marine Propulsion. H. A. Mavor and Mavor and Coulson, Ltd. 19,072. May 24th.

Method of Regulating the Electric Potential of a Network Supplied by a Generator Driven at Very Variable Speeds and Apparatus Therefor. O. Schaller. 16,781. July 22nd. (Date applied for under International Convention, August 11th, 1906.)

Mariners' Compasses. J. C. Dobbie. 19,224. August 22nd.

Electro-Magnetic Cut-Outs or Circuit Breakers. J. Lecoche. 19,241. August 27th.

Electrical Propulsion of Marine Vessels. H. A. Mavor and J. H. Biles. 19,424. August 29th.

Electric Incandescence Lamps having Holders or Suspenders for the Filaments. Deutsche Gasglühlicht Akt.-Ges. (Auerges.) 19,562. August 31st. (Date applied for under International Convention, April 15th, 1907.)

Electrical Switches. J. W. Huntingdon. 20,068. October 9th.

Means for Governing the Speed of Alternating-Current Commutator Machines. H. C. E. Jacoby. 20,495. September 14th.

Mountings or Fittings for Tubular Incandescent Electric Lamps. D. Assersohn. 21,197. September 24th.

Secondary Batteries. E. L. Oppermann. 22,211. October 8th.

Alternating-Current Electric Motors. H. C. E. Jacoby. 22,526. October 12th.

Electric Lifts. C. G. Major, E. C. Stevens and P. H. Stevens. 23,303. October 22nd.

Wire Stringing Devices Applicable for Use in the Insulation of Wire and for other Purposes. British Thomson-Houston Co. (General Electric Co., United States.) 23,809. October 28th.

Counting Trains for Electricity Meters. W. S. Sprague and G. Hookham. 24,291. November 2nd.

Electrodes. W. Hagen. 24,486. November 5th.

Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co., United States.) 24,992. November 11th.

Electric Track Circuits for Railway Signalling. F. B. Holt and A. Wallis. 25,340. November 15th.

Electrical Deposition of Metals. A. Levy. 25,553. November 18th.

Brush-Holders for Electrical Machines. J. H. Woolliscroft. 26,352. November 28th.

Electric Sparking Devices and the like. G. Bartels and Land und Seekabelwerke Akt.-Ges. 26,844. December 4th.

Apparatus for Welding Rings, Hoops, Chain Links and the like by means of an Electric Current. Allgemeine Elektricitäts Ges. 27,926. December 18th. (Date applied for under International Convention, January 4th, 1907.)

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Electricity Meters. G. Hookham and Chamberlain & Hookham, Ltd. 1,502. January 22nd.

Alternating-Current Relays. J. B. Struble. 3,056. February 11th. (Date applied for under International Convention, February 18th, 1907.)

Facsimile Telegraphs. G. T. de G. Garcia. 3,728. February 19th.

Recording Arrangements or Apparatus for Use Chiefly in Connection with Electrical Measuring Instruments. Siemens Bros. Dynamo Works, J. Dalziel, R. Brooks and C. F. Jenkins. 4,111. February 24th.

Electrically-Propelled Motor Car with Single Steering Wheel. C. Lassen. 4,181. February 25th. (Date applied for under International Convention, March 2nd, 1907.)

Apparatus for Bonding Rails and Similar Conductors. G. Harrison. (Electric Railway Improvement Co., United States.) 5,016. March 5th.

Electric Clocks. J. Neale and E. Powell. 5,054. March 5th.

Automatic Electric Fire and Heat Alarm. J. W. Butterworth. 5,271. March 9th. (Date applied for under International Convention, October 23rd, 1907.)

Electro Automatic Sounding Apparatus. C. F. Varela. 5,444. March 11th.

Brush-Holders for Dynamo-Electric Machines. J. H. St. H. Mawdsley. 6,170. March 19th.

Electric Wire Poles or Masts. J. Jaeger. 9,569. May 2nd. (Date applied for under International Convention, May 8th, 1907.)

Means for Preventing Induction Between Electric Conductors. I. Kitsee. 10,343. May 13th.

Insulators for Overhead Systems of Electric Railways and the like. F. Guillot. 11,346. May 25th. (Date applied for under International Convention, October 10th, 1907.)

Oil Switches and other Oil Immersed Apparatus for Alternating Electric Currents. Siemens Bros. Dynamo Works, Ltd., and M. Kloss. 12,389. June 9th.

Brakes for Electric Motor Cars. C. Degoumois. 13,133. June 19th. (Date applied for under International Convention, June 21st, 1907.)

Fuse Holders. Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke Ges.) 13,450. June 24th.

Telegraphic Relays or Receiving Devices. I. Kitsee. 14,116. July 3rd.

Electrical Water Heaters. E. J. Condon. 15,377. July 27th. (Date applied for under International Convention, November 1st, 1906.) (Originally included in No. 23,801/07.)

Electric Steel.—Writing to *La Lumière Electrique*, of September 5th, a director of the Gesellschaft für Elektrastahlanlagen gives a list of Kjellin and Röchling-Rodenbauser induction furnaces already installed or under construction. These number seven in Germany, four in Luxemburg, two in Austria, one each in Italy, Switzerland, Belgium and Spain, two in Sweden, two in England (Sheffield and London, both small), and two in Canada—total 23, of which 17 have a capacity of from 1 to 8½ tons per charge. They can be connected to ordinary networks at 50 cycles.

Dr. E. Gerlenkvichen, in *Stahl und Eisen*, has recently pointed out that steel manufactured in the electric furnace is almost completely desulphurised, and is comparable with the best Swedish steels. The proportion of sulphur contained in the charges varied from 0·4 to 16 per cent., but three out of four test pieces showed after electrical treatment less than 0·1 per cent., and the proportion never reached 0·3 per cent. The fact is ascribed to the solubility of sulphides in the slag, which is proportional to the temperature and basicity; as the temperature reaches a very high value in the electric furnace, and the slag is highly basic, the slag takes up the bulk of the sulphur compounds, leaving but a trace in the metal. The desulphurisation is independent of the chemical composition of the melt, and has no influence upon the other elements of which the steel is composed.